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Electrical Review

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THE "DEADLY THIRD RAIL."

In New York city the daily newspapers must have sensations or they perish. The latest subject upon which the attention of their writers has focused itself is the third-rail equipment of the elevated railway system in Brooklyn and that to be installed in Manhattan. It may be remembered that a few years ago the trolley system of Brooklyn was never called, in the "yellow press," anything but "the deadly trolley" or "the Juggernaut Chariot." Every trifling accident that occurred—and accidents are unavoidable when several hundred miles of track are operated at high speed in the streets of a crowded city—was heralded under flaming scare-heads and chronicled as an addition to the list of victims of the infernal trolley. After a while even the "yellow" editor saw the utter absurdity of this sort of thing. The public convenience must be served, and victims of the trolley were more often victims of their own carelessness.

It has happened recently that workmen on the tracks of the elevated railway have been shocked by the exposed third rail, though fully warned of its character and of the consequences of bridging themselves across a five hundred-volt circuit. The vast majority of those that are shocked take the experience as part of the day's work, and go about their business after a moment's pause for recovery, or, possibly, profanity. Once in a while, though, some workman hanging over the edge of the structure insecurely, gets a shock and involuntarily loses his hold and falls to the street. Sometimes he is killed. If he is, the occasion is seized to abuse the third-rail system in every fantastic kind of type known to latter-day journalism.

If there were not occasional tragedies involved the matter would be purely ridiculous. It is only worthy of notice because the indiscriminating attacks of prejudiced and ignorant writers are calculated to create a popular misconception, injurious to the system which is the innocent cause of so much turbulent language. As a matter of fact, the third-rail system is neither more nor less dangerous than any other system using five hundred-volt current. To the general public it is much less dangerous than the overhead trolley, though neither is properly regarded as a source of danger sufficient to cause the deliberate attacks upon it by newspapers and politicians. There are ways of protecting a third rail just as there are ways of putting trolley wires underground. The question is whether it is worth while to do this on private right-of-way on elevated structures to which no one has access except those who are presumably familiar with the system and who take legitimate risks with it as part of their daily duties.

Several curious accidents have taken place recently in New York and Brooklyn on account of dusty fuse boxes under street railway cars. Under some stress of overload a fuse has suddenly blown, setting fire to the bottom of the car and causing entirely unnecessary panic among the passengers, who are alarmed by sudden outbursts of flames. It appears that, frequently, carelessness in caring for and inspecting fuse boxes has been the cause of this happening. It seems worth while to consider circuit breakers for use on trolley cars instead of the familiar fusible cutout. When a fuse blows on a street car it is necessary for the conductor or motorman to climb out, often in the rain and mud, and replace it, when, if there be anything seriously the matter with the machinery, it immediately blows again. It does not seem fashionable to use magazine fuses, and there is always danger of a panic due to the loud noise and brilliant flash made by the rupture of a heavy fuse under five hundred volts. The suggestion of a circuit breaker in place of the fuse is one that certainly seems worth consideration on the part of railway authorities. Of course, these instruments cost more in the first installation, but they consume nothing and can instantly be reset without the necessity for getting under the car and without alarming the passengers unnecessarily.

ELECTRIC POWER TRANSMISSION IN WORKS AND FACTORIES.

One of the most important applications of electric power transmission has been found in the distribution of power from a central source to individual machines and shops of large industrial establishments. It seems that no limitation is set upon the usefulness of this variety of power distribution by either the nature or the size of the plant, so long as it is large enough to require a considerable amount of power for its purposes. On another page of this issue is described and illustrated the power transmission plant of the Illinois Steel Company, at South Chicago. This enormous industry has found that electric power transmission, with which it experimented at first on a comparatively small scale, has enabled it to increase its shop output and has reduced, in a large measure, the cost of works operation by replacing numerous scattered boiler and engine units with a central power plant wherein power is economically generated, and from which it is distributed by electricity with the least possible loss.

While this consideration alone—that is, the saving that may be effected by the use of more economical generation and distribution—is a point of large importance, there are many cases in which, important as it is, it is not the factor of largest influence in determining a change from other forms of power application. The electric motor unites, with its extraordinary efficiency, a most remarkable ease of operation and adaptability to various kinds of mechanical purposes. Its speed regulation is, perhaps, more accurate and instantaneous than that of any other mechanical device whatever. In the larger number of industrial applications of power to machines and to tools of all sorts the demand for power is widely variable, while it is of importance to maintain the operating speed as constant as may be. In the familiar case of the printing press the power from the prime mover varies enormously during a single cycle of operation. At the instant of impression the power required for a small fraction of a second is enormously disproportionate to that required merely to move the various parts of the press in preparation for the actual contact of the paper with the types. So with planing and shaping machines, for example, where the power required to move the tool back for a fresh cut is simply that absorbed in friction in the machine and where the load is thrown upon the tool instantaneously. In all such uses as these the speed-governing power of the motor is of extreme importance and its efficient consumption of power under widely varying loads is also a feature of the greatest merit. It is not, however, in these directions only that the availability of the motor has proven itself. Take the case of the familiar traveling crane; these machines work over wide ranges of power but the principal requirement connected with them is ability to regulate the application of power with the utmost nicety so that loads, whether heavy or light, may be picked up, transported and put in place with the least danger of a false movement. It is in such work as this that the electric motor has the field entirely to itself. The rapid advance that has been made in the art of applying motors directly to machines and in the construction and design of motors for such purposes has been very great and noticeable of late years. It was only a little while ago that an electrically driven shop was more or less a curiosity; to-day, such shops are not only common, but are beginning to be looked upon as the standard for proper installation. In the textile industry, in printing, in machine shops and ship yards, and in a large number of other establishments the motor has so well proven its case that nearly all large plants that are now being erected are designed primarily with reference to the use of electrical distribution throughout their various parts. It will be remembered that a few months ago the ELECTRICAL REVIEW described and illustrated the very large and complete plant of the Armour packing houses, at Chicago. This industry requires a considerable amount of power, distributed in small units over a large area and through many buildings, and applied to a very great variety of uses. The economy that was attained by the installation of an electric plant will pay for the plant in a very few years, but beyond and above this, the ease of regulation and perfect fitness of the motor for its work will also result in a saving and general economy of operation that is practically incalculable. The field for such applications of electric power is large and constantly increasing with the growth of the various industries which require power.

The ELECTRICAL REVIEW takes pleasure in presenting, on another page of this issue, portraits and brief biographical sketches of the principal officers of the Association of Edison Illuminating Companies. The convention of this association, as has already been announced, will meet at Saratoga Springs, N. Y., on September 4, 5 and 6, and promises to be one of the most successful ever held. The work done by this association is of the most creditable character, as its members have been drawn from the ranks of men thoroughly conversant with the work they have in hand.

Some time ago, in these pages, it was remarked that everybody in the electrical trade was busy. That was strictly true, and an increasing number of people are still busy and just as busy as they possibly can be in manufacturing, designing, selling and planning electrical installations. Notwithstanding this, though, another symptom is evident, even to the casual observer, which is that the heads of important business enterprises are no longer to be found at their desks, but are away in the woods or at the seashore, or, perchance, in the place to which all good Americans go before or after death—Paris—disporting themselves, resting from their labors and spending some of the money they have lately been making. While this fact is an apparent contradiction, it really proves that what was said about the subject before is strictly true. Six weeks ago it looked as if everybody would be so busy that no one would take a holiday; now the condition of the electrical business is such that more people than ever before can afford to take a holiday, and they are taking it. This does not mean, however, that work is not going on with the same tremendous energy and high rate of production that marked the first few months of the present Summer; it means rather that the season has not only been one of the busiest ever known in the electrical industries in the United States, but has also been one of the most profitable.

THE GROWTH OF THE EDISON CENTRAL STATION BUSINESS.

BY J. H. VAIL.

To those who will pause from the intense pressure of daily business for a few moments, and journey back to take a retrospective view at Menlo Park in 1880, it will be again to marvel and ponder at the wonderful genius and foresight of Thomas A. Edison in formulating at that place, and demonstrating by practical operation, the fundamental principles which have been, and to-day are, the basis of a commercial business, the success of which is without parallel.

Twenty years ago, in the Fall of 1880, the writer had (what he now considers to have been a privilege of inestimable value) charge of the operation of 13 of the original bi-polar dynamos in the old Menlo Park laboratory, and these dynamos generated current which was transmitted through a system of distributing conductors, partially erected overhead and partially laid underground. Electric current was delivered to some 500 or 600 incandescent lamps for street and house lighting.

This served as the original central station, distributing current for house to house lighting, all lamps being maintained at practically the same potential, and each individual lamp being under the control of the user. Electric motive power was also supplied for driving machinery.

To-day the incandescent light, used in unnumbered millions throughout the civilized world, serves almost every purpose for which artificial light is required, and the electric motor is the most economical source of power for many industrial purposes.

At the same place in January, 1881, was tested the first direct-connected generator driven by a Porter-Allen engine at 650 revolutions per minute. This was the forerunner of the splendid engine-driven multipolar generators of the present day.

From the practical standpoint, scientific engineering and mechanical development in the perfection of design and construction have in combination eminently contributed to make possible the great commercial success of the numerous Edison illuminating companies.

In the absence of good engineering and perfect mechanical construction in detail, the financier could not have demonstrated the commercial value of electric lighting.

An innumerable host of details would be required to describe the steps of advancement, but we can select a few salient points that will set forth the leading characteristics.

Dynamos—The bi-polar dynamo originally developed in Menlo Park nobly did the work demanded from it and proved to be the initial machine of its type. The rapid demand for dynamos of larger capacity first led to the doubling up of the field magnets of this style of machine and a lengthening of the armature. These types of machines were known as the Z, 600-light capacity, and the L, 150-light capacity, and the K, 300-light capacity. The next design of bi-polar dynamos had the magnet cores of reduced length and enlarged diameter, but the multiple poles in some instances were followed. These soon gave place to the later types of machines which are the models of the bi-polar generators of the present date.

In 1887 the New York stations in Twenty-sixth and Thirty-ninth streets were designed. The largest bi-polar dynamos that could then be obtained were No. 20, having a capacity of 60 kilowatts. This was followed by a still larger size up to 1889; and in 1890 the slow-speed multipolar generators, driven by triple-expansion condensing engines, were designed, and in 1891 they were first installed in several of the large stations.

From the awkward belt-driven, 60-light bi-polar dynamo of 1880 we have advanced to the beautifully designed and perfected type of direct-connected generators of 1,000, 2,000 and 3,000 kilowatts capacity.

From 1880 to even as late as 1885 the magnetic and electrical properties of iron and copper and their proper relations to each other were imperfectly comprehended, and the results to be obtained from a newly designed dynamo were looked upon as an uncertainty prior to the actual test.

In 1900 the designing of a dynamo is reduced to a science, and with mathematical precision the exact proportions of each are predetermined with wonderful accuracy, when combined resulting in the production of a generator which is admitted to be nearest perfection, and of the highest efficiency of any machine for the conversion of energy produced by human skill.

The system of distribution—The underground system at Menlo Park consisted of copper conductors laid in wood box troughs, the conductors separated by blocks, and surrounded by pitch or asphaltum compound for insulation. The electric tube was then designed.

The original underground system of the Edison Electric Illuminating Company of New York was laid with two-conductor electric tubes, and started service on this system in September, 1882. The large investments required in copper for the two-wire system forced Mr. Edison to devise a system of distribution that would reduce the cost. The first step in this direction was the installation at Roselle, N. J., where three 110-volt lamps as a unit were connected in series. The inconvenience and cost of using three lamps in series, led through further experiments to the development of the three-wire system which until the present date from its low cost and wide range of usefulness has proven to be the system par excellence of electrical distribution for commercial service. The three-wire system under given conditions for comparison of costs saved 62½ per cent of the necessary investment in copper over the two-wire system.

The improvements which have followed from year to year in the manufacture of the tubes, junction boxes and fittings are such that now every item and detail for street construction can be readily obtained to lay an underground system of electric distribution that is subject to an astonishingly low percentage of depreciation.

The system of feeders and distributing mains affords facilities for the distribution of current over extended areas, and the control and maintenance of pressures to a degree eminently satisfactory, and is a most influential factor in the commercial success of the service.

The incandescent lamp—The lamps used in 1881 and 1882 required from 5.2 to 5.6 watts per candle; improvements increased the economy and more extensive use reduced the cost. In 1883 the 10-candle-power lamp was introduced to displace the old 55-volt B lamp. This 10-candle-power lamp proved the advance agent of the high economy lamps of the present time. In 1887 Mr. Edison had so greatly improved the economy of the lamps as to enable all central stations by the installation of new lamps to increase their existing capacity 50 per cent. The development of the lamp has been persistently followed until at the present time its cost in large quantities is less than one-sixth of what it was in 1881 and the economy is now from three to three and one-tenth watts per candle-power.

The switchboard—In the earlier central stations the switchboard was an unknown quantity. The appliances for indicating, regulating and control were few in number, and apparently only needed to a limited extent. These instruments were mounted in convenient locations on

the walls of the stations, with the round conductors of bare copper secured by wooden cleats; this practice was followed for some years with gradual modifications and the centralizing of instruments. The regulation and control of currents of constantly increasing magnitude necessitated a closer assembling of the apparatus, and during 1887, 1888 and 1889 in the stations of the Edison Illuminating Companies of Chicago, New York, Boston, Kansas City, Minneapolis and Toronto the first efforts were made in this direction.

In 1890 the type of panel switchboard was first introduced. Improvements have followed from year to year until now the modern switchboard has a panel devoted to each generator, and to each feeder, with all necessary instruments of the finest class, for regulating and controlling quantities of current; the whole construction being fire-proof. To the high-speed engine must be given its share of credit, its individuality of construction and perfect regulation made possible a reliable and efficient service.

The central station unit of a high-speed engine driving two bi-polar dynamos was early decided upon as the most practicable; the capacity being determined according to the estimated output of the station. To insure reliability no station was allowed to start with less than two units. In a large station with many units the number in operation being determined by the load line, and the ability to build up or reduce the load has been an economical feature highly important. That these generating units were large dividend earners by well-managed companies is the best evidence proving the wisdom of their selection.

From 1883 to 1887 a central station of 1,200 or 1,500 lamps capacity was considered an important enterprise. Such a station would be usually equipped with two water tube boilers, two high-speed engines, two injectors, one boiler feed-pump, a feed water heater and the necessary lines of piping, also four bi-polar dynamos, and a very limited supply of switches, ampere meters and voltage indicators mounted on the walls of the station, in what was then considered good practice, and now would not be permitted.

The operation of such a station was frequently accompanied with many weary hours of anxiety over troubles, too numerous to mention. The kilowatt-hour, which came into vogue in 1891 was then an unestimated quantity. This unit of production is now the basis of all statistical data. When this sort of station is placed side by side and compared with the magnificently equipped productive establishments of the present day, we can then appreciate that each department of electrical and mechanical engineering has contributed in no small degree toward the eminent success attained in 1900. These advances have not been in giant strides but mostly are of slow growth, the outcome of practical experience.

Great economies have been brought about by the use of large generating units driven by slow speed compound condensing engines operating under higher steam pressures; also the more extended use of the current requiring its production in immense quantities is a most important factor.

The comparison of statistical costs of production has served to stimulate each manager to closely scrutinize his details of operating expenses per kilowatt-hour.

The early central stations at Shamokin, Sunbury, Mount Carmel, and Ashland, Pa., Brockton and Fall River, Mass., and at 255 Pearl street, New York, were but the forerunners of the commercial giants of 1900, which in numerous well-known instances have served as the foundations upon which are built the enormous consolidations and aggregations of capital in our larger cities. Take away from these consolidated companies the earnings of the Edison systems and their financial success would totter on the verge of failure.

THE ASSOCIATION OF EDISON ILLUMINATING COMPANIES.

PROGRAMME OF THE FORTHCOMING CONVENTION—THE OFFICERS AND THEIR ELECTRICAL CAREERS.

As already announced in the ELECTRICAL REVIEW, the next convention of the Association of Edison Illuminating Companies will occur at Saratoga Springs, N. Y., on Tuesday, Wednesday and Thursday, September 4, 5 and 6. At the time of going to press the programme as decided upon is as follows:

"Some Notes on Electric Elevators;" Arthur Williams, New York.

"Systems and Apparatus for Light and Power Distribution;" C. P. Steinmetz, Schenectady, N. Y.

"Polyphase Distribution;" G. Semenza, Milan.

"Electric Elevators and Electric Hoists;" John F. Gilchrist, Chicago.

"The Electrical Features of the Paris Exposition;" W. C. L. Eglin, Philadelphia, Pa.

"The Year's Improvements in Meters and Measuring;" C. D. Haskins, Schenectady, N. Y.

"Residence Rates in Detroit;" Alex Dow, Detroit, Mich.

"Arc Lighting Systems;" Walter Fish, Lynn, Mass.

"Distribution from Transmission Circuits;" D. L. Huntington, Spokane, Wash.

"The Past, Present and Future of the Incandescent Lamp;" John W. Howell, Harrison, N. J.

"Efficiency of Electric Distributing Systems;" F. Torchio, New York.

"Results in the Application of the Maximum Demand Rate System;" C. S. Knight, Boston, Mass.

"Twenty-five Cycles *vs.* Sixty Cycles for Union Lighting Station;" C. F. Stott, Buffalo, N. Y.

On Friday, September 7, by invitation of the General Electric Company, the delegates and guests will be taken by special train to Schenectady to visit the works of the General Electric Company.

In connection with the forthcoming meeting the ELECTRICAL REVIEW takes pleasure in publishing herewith portraits and brief biographical sketches of the principal officers of the Association of Edison Illuminating Companies:

JOHN W. LIEB, JR., PRESIDENT.

Mr. John W. Lieb, Jr., president of the Association of Edison Illuminating Companies, was born in 1860, in Newark, N. J., attended school at the Newark Academy and the Stevens High School, Hoboken, and was graduated in 1880, with the degree of Mechanical Engineer from the Stevens Institute of Technology. He became associated almost at once with the electrical industries as draughtsman with the Brush Electric Company, Cleveland. In 1881 he accepted an appointment as draughtsman with the Edison Electric Light Company, and co-operated in preparing the working drawings for the "Jumbo" dynamos. He was transferred to the Testing Department of the Edison Machine Works in Goerck street and was there engaged in general testing and experimental work on many of Mr. Edison's inventions. On the completion of the first "Jumbo" dynamos, Mr. Edison placed him in charge of their installation and of the electrical equipment of the historic Pearl street station. When the Pearl street station began regular service in the Fall of 1882, Mr. Lieb was placed in charge as chief electrician.

In the latter part of 1882 a syndicate of capitalists was organized in Milan, Italy, orders were placed with the Edison Company for the complete equipment of a central station and underground system in that cosmopolitan city, and Mr. Lieb was selected by Mr. Edison to take charge of the erection of the equipment. On the organization of the Italian Edison Company in 1883, Mr. Lieb became its chief electrician, and, later, chief engineer and

manager of stations, continuing in this relation until 1894, when he returned to the United States to resume his connection with the Edison Electric Illuminating Company, of New York.

While in Milan he had general charge of the technical work of the Italian Edison Company, supervising its construction

MR. JOHN W. LIEB, JR., PRESIDENT OF THE ASSOCIATION OF EDISON ILLUMINATING COMPANIES.

work in various parts of Italy, and operating the Milan central station, using the Edison two and three-wire systems, the Thomson-Houston arc-light system and the alternating-current system of distribution, in the introduction of which Mr. Lieb was one of the pioneers. Under his direction were made some of the first tests in operating alternators in parallel and underground alternating-current distribution. His last work in Milan was the equipment in 1893 of an experimental line of overhead trolley, which system has since been extended over the entire city.

Mr. Lieb, on returning to New York, was appointed assistant general manager and then general manager and third vice-president of the Edison Electric Illuminating Company, of New York, which position he now holds. He is also the associate general manager of the New York Gas and Electric Light, Heat and Power Company.

Mr. Lieb is a trustee of the Stevens Institute of Technology, president of the Association of Edison Illuminating Companies and of the Lamp Testing Bureau, vice-president of the American Institute of Electrical Engineers, past president of the New York Electrical Society, and a member of the American Society of Civil Engineers and American Society of Mechanical Engineers.

W. S. BARSTOW, TREASURER.

Mr. William Slocum Barstow, the treasurer of the association of Edison Illuminating Companies, is very well known to central station men throughout the country. While his work has been chiefly with the company he is now connected with, it has been of such character as to win him credit and a wide acquaintance throughout the United States. Mr. Barstow was graduated from Adelphi Academy in 1883, and from Columbia College in 1887. His first electrical experience was acquired with the old Edison Machine Works with which he was connected, after leaving college, until 1889. In the latter year he was made assistant superintendent of the Edison Electric Illuminating Company, of Brooklyn, N. Y., and in 1890, he became general superintendent of the same company, a position which he held until 1896, when he was made general manager of the Brooklyn Edison Company, a position which he holds at the present time. Mr. Barstow as readily may be imagined, holds a position of considerable responsibility as general manager of the various companies which control the entire central station lighting of the Borough of Brooklyn, N. Y. He has taken great interest in the work of the American Institute of Electrical Engineers, the National Electric Light Association, and the New York Electrical Society.

WILSON S. HOWELL, SECRETARY.

Mr. Wilson S. Howell, secretary of the Association of Edison Illuminating Companies, began his electrical career when he entered the laboratory of Thomas A.

MR. W. S. BARSTOW, TREASURER OF THE ASSOCIATION OF EDISON ILLUMINATING COMPANIES.

Edison, at Menlo Park, N. J., in December, 1879. Soon after this the first exhibition of incandescent lamps was made by the public lighting of the grounds and street adjoining Mr. Edison's laboratory. The lamp used was the old paper horseshoe lamp. In 1880 Mr. Howell took charge of laying the underground conductors for a larger demonstration to satisfy the directors of the Edison Electric Light Company.

In 1881, Mr. Howell entered the service of the Edison Electric Light Company, as manager of the marine department, in which capacity he secured a contract for the equipment of the steamer City of Worcester. This was the first piece of work done by the Edison Electric Light Company, and called for dynamos Nos. 1 and 2. The marine department being merged with the isolated department, under the name of the Edison Company for Isolated Lighting, under the management of Mr. Miller F. Moore, Mr. Howell was put in charge of the installation of isolated plants, with headquarters at Philadelphia. This position he resigned to take charge of the small Edison station at Roselle, N. J. This was one of the pioneer stations operating three lamps in series on a 330-volt two-wire system. After finishing this plant, Mr. Howell became agent for the Edison Electric Light Company, for the sale of central station franchises, and in this position he negotiated the contract with the Edison Electric Illuminating Company, of New Brunswick, which plant he afterward built and operated for two years. This was the first station using continuous cable feeders, as distinguished from the joined Edison tube, and was the first to concentrate all of its indicating and regulating apparatus on a compact switchboard within easy reach of the throttles of the engines.

During his experience with the New Brunswick plant, Mr. Howell made a specialty of the regulation of pressure with reference to economy of lamp renewals and the maintenance of commercially constant illumination. His success in this direction brought to him a considerable outside business as an advising and consulting engineer. In order to attend to this work Mr. Howell resigned his position with the New Brunswick Company, and for two years and a half conducted an independent business, principally in adjusting distribution conditions and pressure regulation of Edison three-wire systems. So much of his time was taken up with the Edison Lamp Company in adjusting claims received from their customers that he permanently entered their service in 1888 and continued as an adjuster of claims.

In October, 1896, Mr. Howell entered the service of the Association of Edison Illuminating Companies as lamp testing officer of their Lamp Testing Bureau, which position he held until May 1, 1899, when the business of the Lamp Testing Bureau was transferred to a company of the same name, organized under the auspices

MR. WILSON S. HOWELL, SECRETARY OF THE ASSOCIATION OF EDISON ILLUMINATING COMPANIES.

of the Association of Edison Illuminating Companies. Mr. Howell was elected treasurer of the association in 1886, and held that office until 1894. In 1890 he was made an honorary member, and in 1897 was elected secretary of the association, which position he now fills. He is also a member of the American Institute of Electrical Engineers.

The Electrically Driven Plant of the Illinois Steel Company.

The plant of the Illinois Steel Company, at South Chicago, Ill., shows, in a striking manner, the advantages that are to be derived from the use of electricity as a motive power in place of steam and other methods of driving. After having tried various other methods of operating, including steam, hydraulic and pneumatic power, the company, in 1894, began to install electric machinery. In 1895 it had some 50 motors in use, aggregating 650 horse-power, operating cranes and ingot-charging machines. In 1898 the number of motors had increased to 100, aggregating 1,800 horse-power, and at the beginning of 1900 the total horse-power of the electric motor installation had grown to 4,000. Motors aggregating 2,000 horse-power are now being added. In addition to the operation of cranes and ingot-charging machines, electric motors are now applied to swinging or stationary hoists and derricks, transferring and conveying machinery, including a number of powerful electromagnetic lifters for steel plates, isolated shears, fans, rolls, pumps, etc.

Some interesting comparisons have been made between the cost of operating the electric plant and the other systems of driving that have been in use. For instance, a scrap-breaking, or drop, machine, operated at a distance of 1,000 feet from the source of power, costs 35.4 cents per hour, with steam as the motive power; while now, driven by an electric motor, it costs only 6.4 cents per hour. If operated by a separate steam plant, it is estimated that it would cost 56 cents per hour to run this machine.

In a plant of this size it is possible to deliver electric power to the various machines at a cost of from one-half to one cent per kilowatt-hour. In addition to this economy in the cost of power, a very considerable increase is found in the efficiency of the machine itself, and generally a decrease in the cost of labor. Thus, with the plate-handling cranes, when equipped with powerful electromagnetic lifters, it is found that one man and one crane can do the work of six men and two cranes without the use of electrical apparatus.

The boiler room contains six 250 horse-power boilers, working at 125 pounds pressure. There are three engines, two of the tandem type and one vertical compound. These engines drive three Westinghouse direct-current dynamos, two of 400 kilowatts each, and one of 300 kilowatts, all operating at 250 volts. A fourth dynamo of 1,050 kilowatts capacity is to be installed.

A notable feature of the installation is the large total horse-power of motors operated from a power plant of relatively small capacity. The present dynamos, aggregating 1,100 kilowatts, or about 1,470 horse-power, operate electric motors aggregating 4,000 horse-power. Any one not familiar with the operation of large industrial establishments would be struck by the disparity between the capacity of the generators and that of the motors. In this instance, the average load on the generators is only about 750 horse-power, or only 18 per cent of the total rated capacity of the motors. This, however, is in accordance with general experience, comparatively little of the machinery in such a manufacturing plant being run continuously. Thus, in the case of the traveling cranes, the motors are in operation for only a small portion of the total working time of the plant, and thus throw on the generators an average load that is very slight indeed. The same is true, though to a lesser degree, of the motors operating rolls, pumps, shears, conveying machinery, etc.

In the case of this plant, the capacity of the generators is only about 35 per cent of that of the motors. In some plants the percentage is smaller; while in others, in which the machinery is run less intermittently, the percentage is considerably greater. But in no case is it necessary to install generators equal in capacity to the motors.

The transmission lines have been figured for a loss of 10 per cent, the longest distance over which power is transmitted being 2,000 feet, and the average distance about 900 feet. The works are lighted by 300 enclosed and 400 open arcs, and by 3,700 incandescent lights, operated on both direct and alternating circuits. A somewhat unusual feature of the plant is a double system of steam piping. Engines and boilers are all connected to each of two sets of pipes which may be used interchangeably.

FIG. 1.—A 75-TON ELECTRIC CRANE OPERATING A LADLE FOR FILLING INGOT MOULDS AT THE ILLINOIS STEEL COMPANY'S PLANT

Canadian Electrical Association.

The Canadian Electrical Association is holding its tenth convention at Kingston, Ontario, this week, the dates of the meeting being August 29, 30 and 31. Headquarters are at the Hotel Frontenac, and an exhibition of electrical apparatus and supplies will be held in the City Hall. The local street railway company has offered the courtesies of its road to the attending delegates. The programme of papers to be read is as follows:

"Use of Dynamo and Storage Battery in Telegraph Offices."

Mr. W. J. Camp, C.P.R. Telegraph Company, Montreal.

"Utilizing the Available Central Station Capacity." Professor R. B. Owens, McGill University, Montreal.

"Power Factor as Affecting Operation and Investment with Special Reference to Induction Motors and Enclosed Arc-Lamps." Mr. F. H. Leonard, Jr., Montreal.

"Conditions Affecting the Wave Form of Alternators." Professor L. A. Herdt, McGill University, Montreal.

"Rotary Converters." Mr. A. Gordon Grier and Mr. J. C. Hyde, Montreal.

"Railway Subject, Giving Several Curves Showing Up the Average Power During a Day, and Maximum and Minimum Requirements for Power Called For on the Quebec System." Mr. Blair, Quebec Railway and Lighting Company, Quebec.

Numerous excursions, including a searchlight trip through the Thousand Islands, have been arranged. The annual banquet will be held on Friday evening. Mr. A. A. Dion, general superintendent of the Ottawa, Ont., Electric Company, is the president of the association, and Mr. C. H. Mortimer, editor of the *Electrical News*, Toronto, Ont., is the secretary and treasurer.

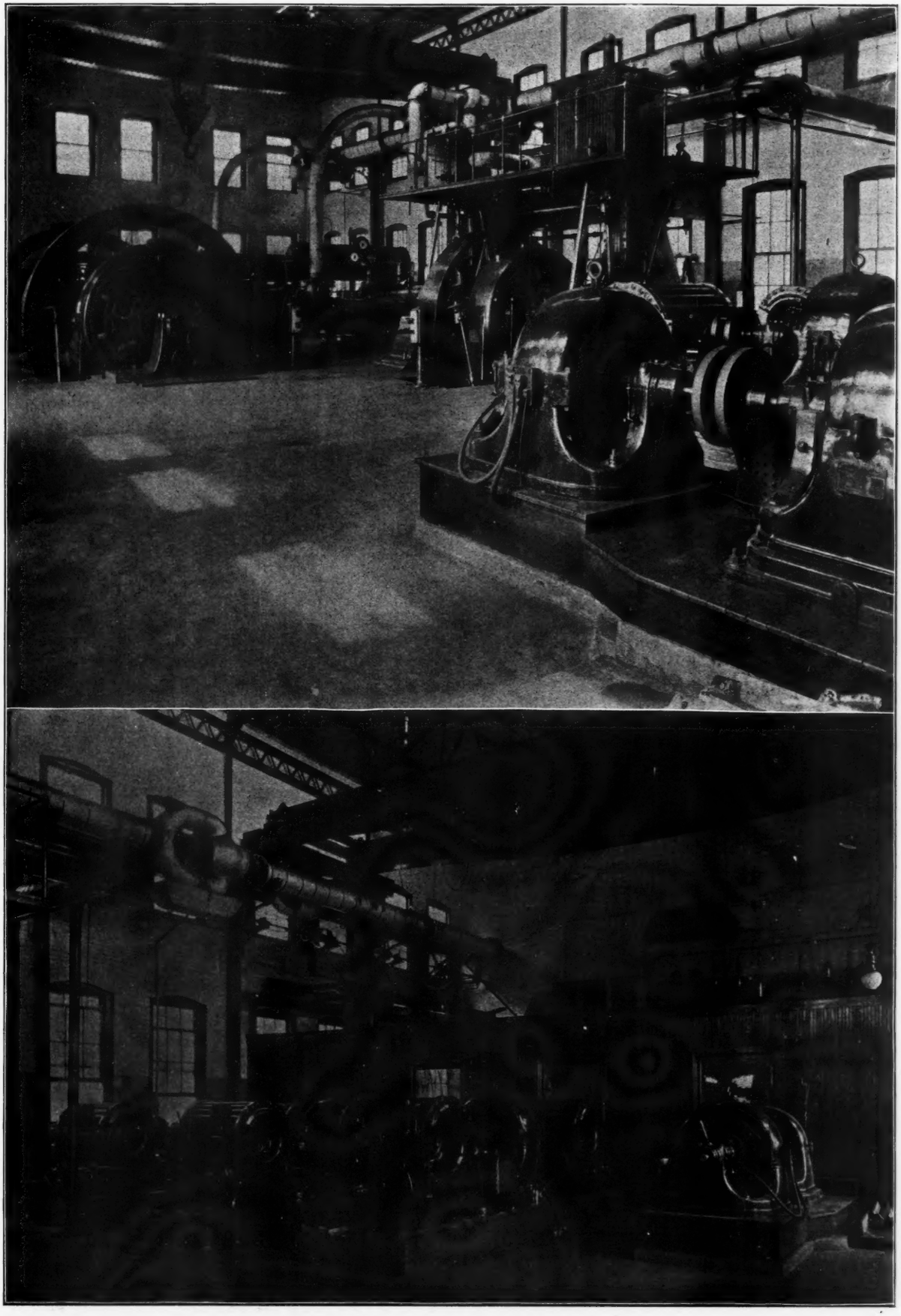
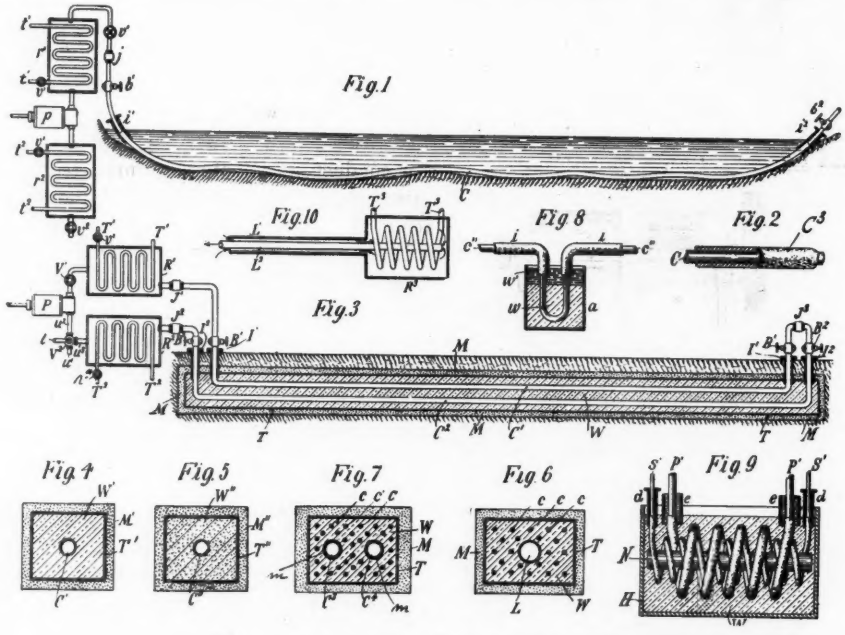


FIG. 2.—THE GENERATING PLANT OF THE ILLINOIS STEEL COMPANY'S WORKS, AT SOUTH CHICAGO, ILL.
FIG. 3.—THE ELECTRIC LIGHTING PLANT OF THE ILLINOIS STEEL COMPANY, SHOWING GENERATORS DRIVEN BY DIRECT-COUPLED ELECTRIC MOTORS.

RECENT ELECTRICAL PATENTS

A recent patent has been granted to Nikola Tesla for a method of insulating electric conductors. It has long been known that many substances which are more or less conducting when in the fluid condition become insulators when solidified. Thus water, which is in a measure conducting, acquires insulating properties when converted into ice. Faraday estimated that the substances upon which he experimented, such as water and aqueous solutions, insulate an electrically-charged conductor about one hundred times better when rendered solid by freezing. In the course of Tesla's investigations, more especially those of the electric properties of ice, he has discovered some novel and important facts, of which the more prominent are the following: First, that under certain conditions, when the leakage of the electric charge ordinarily taking place is rigorously prevented, ice proves itself to be a much better insulator than has heretofore appeared; second, that its insulating properties may be still further improved by the addition of other bodies to the water; third, that the dielectric strength of ice or other frozen aqueous substance increases with the reduction of temperature and corresponding increase of hardness; and, fourth, that these bodies afford a still more effective insulation for conductors carrying intermittent or alternating currents, particularly of high rates, surprisingly thin layers of ice being capable of withstanding electro-motive forces of many hundreds and even thousands of volts. These and other observations have led Tesla to the invention of a novel method of insulating conductors, rendered practicable by reason of the above facts and advantageous in the utilization of electrical energy for industrial and commercial purposes. Broadly stated, the method consists in insulating an electric conductor by freezing and solidifying, and maintaining in such state by the circulation of a cooling agent, the material surrounding or contiguous to the conductor. In the practical carrying out of his method, Tesla employs a hollow conductor and passes the cooling agent through the same, thus freezing the water or other medium in contact with or close to such conductor, or he may use expressly for the circulation of the cooling agent an independent channel and freeze or solidify the adjacent substance, in which any number of conductors may be embedded. The conductors may be bare or covered with some material which is capable of keeping them insulated when it is frozen or solidified. The frozen mass may be in direct touch with the surrounding medium or it may be, in a degree, protected from contact with the same by an inclosure more or less impervious to heat. The cooling agent may be any kind of liquid, preferably of low freezing point, as brine, or it may be a gas, as atmospheric air, oxygen, carbonic acid, ammonia, illuminating gas or hydrogen. It may be forced through the channel by gravity pressure, or suction, produced mechanically or otherwise, or by any other kind of force. It may be continually renewed or indefinitely used by being alternately volatilized and condensed or evaporated and absorbed and mechanically driven back and forth or steadily circulated in a closed path under any suitable conditions as regards pressure, density, temperature and velocity.

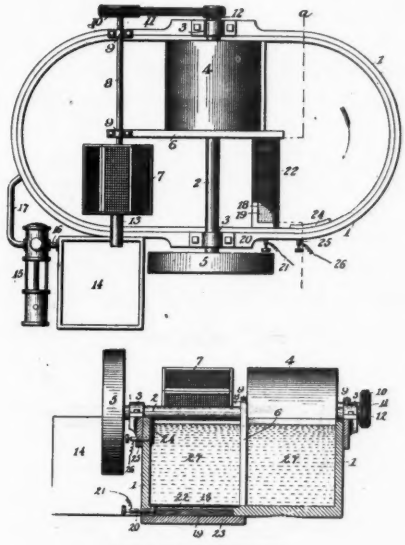


METHOD OF INSULATING ELECTRIC CONDUCTORS.

A patent has been granted recently for a device by means of which a secondary battery may be carried on motor vehicles without danger of being broken or otherwise injured by violent shaking or jolting, to which such vehicles are often subjected when running; and it also provides means for protecting the vehicle itself from being defaced or otherwise injured by the electrolyte used in such batteries in case it stops or is spilled from the cells. The invention consists broadly of a box or receptacle adapted to contain cells and having a pneumatic cushion on which the cells are supported, which may be accomplished in several ways. One form being to rest the pneumatic cushion on the true bottom of the box and place a false bottom on the cushion. Another form is to omit the false bottom and rest the cells upon the cushion, and still another form is to support the box itself upon a cushion. In order to prevent any electrolyte from the cells which may be spilled from leaking from the box, a flap is provided extending upward from the cushion and forming a continuous strip around the inside of the box of such a height as to hold the entire liquid contents of a number of the cells in case one or more should be broken while the vehicle is in use.

In bleaching vegetable fibre, such as paper pulp, cotton or linen goods, by a new process invented by Thomas Jespersen, of Neenah, Wis., electricity is used to decompose a dilute watery solution of hydrochloric acid in such a way that the chlorine gas evolved at the immersed anode is absorbed by the water of the surrounding watery solution of the electrolyte, forming thereby chlorine water. Thus the watery solution serves as an electrolyte and as a carrier of chlorine simultaneously. The material to be bleached is also held suspended in this solution and may be agitated in a convenient manner to facilitate the uniform saturation of the contents of the tank in which the material to be bleached is held. The bleaching now proceeds in the usual manner by the decomposition of the water by the absorbed chlorine yielding nascent oxygen and hydrochloric acid. Thus chlorine, while combining with the hydrogen of the water, is constantly reproducing an electrolyte (hydrochloric acid), which can again be

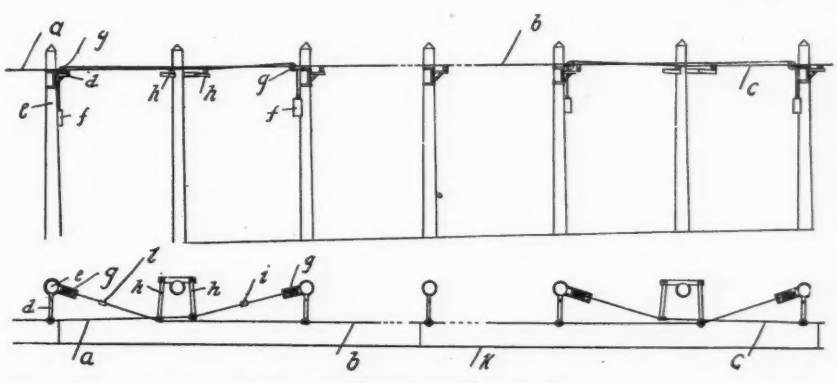
subjected to the action of the electric current, yielding at the anode chlorine, which, as before, will be absorbed by the water, decomposing it to form oxygen and hydrochloric acid, as before, and at the cathode hydrogen, which is allowed to escape. Thus the chlorine may be used over and over in the same manner indefinitely, thereby cheapening the process of bleaching by saving material. In using hydrochloric



BLEACHING SYSTEM.

acid as an electrolyte in bleaching fibrous substances, there are two distinct features for which originality and superior usefulness is claimed over other processes heretofore used: First, the direct formation of chlorine water without the use of a porous partition and without the intermediate formation of a hypochlorite; and, second, the automatic reconversion of free chlorine into hydrochloric acid by the decomposition of water. To this aqueous solution of hydrochloric acid may be added one or more soluble chlorides, which, however, will not change the chemical reaction nor the ultimate result. In order to carry out the process, it is essential that a suitable tank is provided for holding the necessary solution, the material to be bleached, and the electrolyzing apparatus. If the material to be bleached is paper stock, the usual washer or beater engine tank is preferable (the washer and beater engine being substantially the same in construction), the revolutions of the beater-knife cylinder serving to agitate the paper stock while being acted up by the electrolyzed solution, and its pulp washer serving to remove the watery solution from the paper stock after it has acted upon one charge, that it can be returned to the beater tank for action upon the succeeding charge of material. In bleaching textile fabrics or other material any suitable tank having the anode and cathode arranged in it may be used, and the various operations of agitating the solution and material to be bleached or of removing the liquid from the tank can be performed by manual labor or by any suitable means which is available.

A new improvement in systems of electrical distribution has been devised by a resident of Germany. The principal idea is to provide means for suspending electrical conductors whereby the same may be maintained at uniform tension and whereby upon the breakage of any part of the conductors the broken portion will be grounded automatically. Generally speaking, the improvement comprises a plurality of sections of a single conductor, each section being supplied with current from a common feeder. The individual sections of the conductor or main are supported at intervals in the embodiment of the invention, upon swinging brackets, the ends of each section having weights attached thereto, whereby the sections are individually maintained taut and whereby contraction and expansion in the wires may readily occur, the weights and the lengths of the sections being so proportioned that the slack is always taken up upon expansion of the conductor, the weights being lifted upon contraction thereof. At present, it is customary to mount the wires by stationary cross-wires, the connecting insulators rigidly holding the distributing wires in mechanical connection with their supports. It is therefore necessary, especially in electrical railway practice, so to design the system that the wires will have a sufficiently large sag to compensate for contraction to which the wires are subjected in cold weather. For this reason it is impossible to keep the spans of wire under any uniform or constant tension. The variable strains caused react harmfully upon the material of the wire and its supports. The present invention supplies a means whereby these defects are overcome. A way is also provided of short circuiting or grounding any section of a main conductor that may become broken or separated from a weight. This consists, in the preferred embodiment of the invention, in providing back grounded or short circuiting contacts against which contacts carried by the swinging arms are adapted to strike, the latter contacts being connected with the wire sections. The invention has been patented in this country and is controlled by the Siemens & Halske Electric Company.



SYSTEM OF ELECTRICAL DISTRIBUTION.

Patents in Cuba.

The following information in regard to Cuban patents was published recently in Havana:

"All persons being in legal possession of patents of invention taken out in Madrid, Spain, and registered for the island of Cuba, must file, within a term of six months from this date, the duplicates of the specifications, drawings and models belonging to their patents or a certified copy of the same, together with a certificate showing that their patents are in force in Spain, so that such patents may be protected against infringers.

"American patents that have been presented for registration in Cuba and those which will so be in future, shall be registered at once, provisionally, in the special register kept by the secretary of agriculture, commerce and industry, on condition of deciding in due course of time what may be deemed fit about the final registration or absolute rejection of those resulting really interferred in accordance with the documents filed within the term of six months prescribed by the first part of this order; it being well understood that after the expiration of said term, the registration shall become definite, as the task of deciding upon all subsequent discussions between parties, will be left for the courts of justice."

SCIENCE BREVITIES

Reversibility of Voltaic Cells—Under the title of "Reversibility of Voltaic Cells," Mr. P. S. Moore has communicated to the Physical Society the results of some interesting and instructive experiments which he has made as to the effect on the electro-motive force and internal resistance of certain cells, of sending an opposing current through them, says our London namesake. Five cells were tried, formed as follows: Copper zinc in sulphates, copper cadmium in sulphates, copper zinc in chlorides and copper cadmium in chlorides, and also the Clark cell. For the experiments a Crompton potentiometer was used. Each cell consisted of two glass vessels (short boiling tubes) which had side tubes blown in them. These side tubes were connected by a short piece of india-rubber tube, to which was attached a screw clip. It was found that, unless wads of cotton wool were placed in the connecting tubes, it was necessary to have solutions whose densities only differed in the fourth place. With the wads there was practically no diffusion, and the internal resistance was not unduly high. The solutions were made up approximately to the formula R. 100 H_2O, where R is the molecular formula of any salt. The densities were then adjusted until they were approximately equal. The description of the experiments is somewhat confused and unsatisfactory, and the densities of the currents are not worked out and given. Mr. Moore sums up the results of his experiments as follows: "During the experiments, so long as diffusion was prevented, the electromotive force of the cells remained constant. Even under the most unfavorable circumstances, *viz.*, when the reverse current through 4,000 ohms was running through the cell, the electromotive force only altered about two millivolts. The conclusion to be drawn from the results is that the cells treated, and consequently all similarly constituted cells, are reversible; for the differences in the values of the electro-motive forces, when calculated and when observed, are not greater than might be expected as errors of experiment. A few experiments were also carried out with the Clark cell. In the first experiments the Clark standard consisted of two Clark cells in parallel. These were now separated, and one used as a standard and the other as the experimental cell. The internal resistance of this cell is, of course, comparatively large, so that it was necessary to use smaller resistances than were used in the previous cases. These resistances were therefore made equal to 3,000, 2,000 and 1,000 ohms respectively. With the resistance equaling 1,000 ohms, it was found that the current was much too large, as the electromotive force of the cell decreased very rapidly when running the current. But the reverse current gave a fairly good result, as might be expected. For the direct current would cause the solution of Hg_2SO_4 to become weaker, and the solid present would not immediately saturate the solution. But the reverse current would cause Hg_2SO_4 to be formed in the solution, which would therefore deposit some solid, but would at the same time remain saturated. Thus, all the results from the reverse experiments are better than the corresponding direct results; but considering the nature of the cell, these latter are fairly good. Thus we may say that the Clark cell, besides the others treated here, and those similar to them, is reversible."

An Adjustable Capacity—It is sometimes convenient, when experimenting on electrical phenomena, to have a condenser the capacity of which can be varied gradually over a wide range. This has usually been done to a limited extent by taking out connections from a number of tin-foil sheets, and also dividing the condenser up into sections. The variation in this case can not be made conveniently without interruptions to the experiment, which is sometimes most inconvenient. In the July number of the *Physical Review,* Mr. Lyman J. Briggs describes a new form of condenser which can be adjusted for capacity without the above objection. It consists of a number of sheets of brass which are curved with a radius of from six inches to eight inches; in fact, the curvature which is always found in thin brass sheet from being rolled up is quite sufficient for the purpose. The insulation used between the sheets is mica. The brass sheets are so placed with the curvature first in one direction and then another, that the air space between them can be varied very much by the pressure which is applied on the two surfaces of the pile. The brass sheets are held in the correct positions relative to each other by four rods, which pass through holes at the four corners of the condenser. The brass plates make connection with these rods. There are only two holes through each brass plate, which are of such a length that while they thread on to one pair of rods they leave a good clearance between the end of each plate and the other two rods. The range in capacity of these condensers can be gathered from the following figures: A small condenser, consisting of 13 plates on each side, the plates being about two inches by three and one-quarter inches, had a capacity in air of 0.055 of a microfarad when compressed, while its capacity was only 0.013 of the microfarad when the screw used to compress the plates was slacked back. This ratio, giving a variation of over 400 per cent, has been exceeded by other types made on the same general lines. The author also gives interesting curves which show the relation between the over-all thickness of the condenser and its capacity. It seems from this that the connection between the two is by no means a straight line, as might be expected.

Electric Effects of Light upon Green Leaves—Under certain favorable conditions, which are not as yet completely determined, green leaves show a true electrical response to light, consisting in the establishment of a potential difference between the illuminated and the non-illuminated half of a leaf which may amount to 0.02 volt, says Mr. A. D. Waller, in a communication to the Royal Society, briefly abstracted by the *Electrician.* This effect shows a remarkable similarity with the effect of electric excitation upon nerve and muscle. In the human nerve substance, electric excitation causes a current from the resting to the active tissue, followed after a few seconds by a smaller current in the opposite direction. In Iris leaves, the current flows from the illuminated to the shaded half of the leaf during illumination, and in the opposite direction for about five minutes after the illumination has ceased. The response takes about four seconds to set in, and it is only the young and growing leaves that show any response. When the stimulus is repeated, a certain amount of fatigue is shown, as in all organic structures and even in some inorganic substances. But no fatigue is shown when the leaf is given an hour to recover between each stimulus. The tobacco plant acts like Iris, but in Tropæolum and other plants the currents are in the opposite direction. That chlorophyll is essential to this photo-electric reaction is shown by the fact that the petals of flowers do not show it.

Aluminum Electroscope — A use of aluminum in delicate instruments is mentioned by the *Electrotechnische Zeitschrift* in describing a vacuum electroscope. The apparatus is in the form of a pear about 4½ inches in length. The top consists of a hollow aluminum sphere, which rests upon an aluminum wire welded into the glass.

From the International Exposition in 1878 to that in 1900.

[*From the London Electrical Engineer.*]

Twenty-two years ago Paris was engaged, as now, with an international exhibition. Then Gramme, Jablochkoff, Plante, and one or two others, made that leap in electrical practice which has since given rise to the dominant industry of the world. Till then various men had labored and experimented, but the results of the labors and experiments had not taken the world by storm; but the time had come and since that exhibition there has been no going back. Even with the glamor of the 1878 exhibition upon us but few believed in the possibilities of electric light as an artificial illuminant. If any reader cares to do so, let him turn up the *Journal of Science* for February, 1879, and he will find therein two or three very suggestive papers. In one, Mr. W. Mattieu Williams details his experience from 1845 onward with investigations into the applications of electricity. His conclusions are emphatically stated. He says: "During the intervening 30 years I have abstained from further meddling with the electric light, because all that I have seen then and heard of since has convinced me that, although as a scientific achievement the electric light is a splendid success, its practical application to all purposes where cost is a matter of serious consideration is a complete and hopeless failure, and must of necessity continue to be so." What danger there is in prophesying unless you know, and how often during the past 20 years must Mr. Mattieu Williams have wished those words unsaid. Had the conclusions been different, it is possible we should not have had to wait till this year of grace to know how near Mr. Staite and his colleagues were to the solution of the problem, not only as regards the lamp, but also the dynamo. It was Gramme's work in the latter direction that made progress possible and rapid. Williams refers to Staite's attempt to obtain a lamp by means of a carbon rod in a Torricellian vacuum, and Professor Ayrton in the same number describes his work upon such a lamp as long back as 1873, though after obtaining a vacuum he filled his globe with nitrogen. The third paper we have referred to is one by Professors Elihu Thomson and E. J. Houston, showing that size, weight, and cost of the copper conductor required for transmitting power over a distance of 500 miles or more were not, as some writers at that time insisted, prohibitive in either of these directions. It was in April, 1879, that the late Dr. Hopkinson read his first classic paper at the Mechanical Engineers, and started the scientific process of the construction of electrical engineering apparatus. How vast the work done in all directions between the years 1878 and 1881 can be understood by referring to the reports of the electrical exhibition held in Paris in 1881.

The avidity with which electric lighting was taken up in other countries, and especially in America, where the prevailing conditions were altogether in its favor, led to legislative action in this country, and gave us the justly celebrated 1882 Bill. The passing of this Bill led to the following remarks by Sir F. Bramwell: "The passing of this bill must be looked upon as the beginning of the end of the carrying out of public enterprises by means of private capital." He also correctly prophesied stagnation while the inequitable conditions of the Bill remained. As we all know, these conditions had to be modified by a subsequent Act, and then came a period of activity. It is well to occasionally remember the facts of rise and progress. In our last issue we pointed out how useful American energy had been to the industry, and the moral of our present remarks may be taken to indicate that France has by her exhibitions at critical times made the world acquainted with the position of electrical matters, and by these "bold advertisements" has conduced largely, if not entirely, to epoch-making. If the Britishers have not taken kindly to Paris this year, it is not that they deprecate the value of the interchange of opinions or the examination of differences in practice, but from other and varied causes which it is needless to elaborate. The facts remain as we have stated, that the electrical industry owes much to exhibitions at Paris.

The Old-Time Telegraphers' Association.

The convention of the Old-Time Telegraphers' Association, and the United States Military Telegraph Corps, will be held at St. Paul and Minneapolis, Minn., on September 18, 19 and 20. Business meetings of the two associations will be held at St. Paul on September 18, and September 19 will be known as "Minneapolis Day." Numerous entertainments have been arranged and an enjoyable and successful meeting is expected. Mr. John Brandt, secretary of the Old-Timers' Association, is located at 195 Broadway, New York city, and will be glad to give all the information required by intending delegates.

The Berlin Academy of Sciences has made a grant of 1,000 marks to Professor Julius Tafel, of Würzburg, for the continuation of his work on electrolysis.

VIEWS, NEWS AND INTERVIEWS

The heat wave in London has created an opening for electric fans. The *Daily Mail* says that London is the most backward of all great capitals in provision for meeting heat. Although "suction" ventilating fans, driven by electricity, are quite well known, I have never seen an electric fan of the cooling type in use in England. I wonder why our manufacturers in this line neglect their opportunity here, inquires Marshall Halstead, United States Consul at Birmingham, England.

In a large office building up town, in New York city, where a prominent publisher has more than half of a floor for his offices, a simple labor saving device has been installed which is worthy of emulation. An electrical contact on the office door is so arranged that when any one comes out the going-down signal in the elevator cars is automatically set, consequently a person leaving these offices does not have to stand in the hall and figure on which push button to push, but finds the first available elevator stopping for him, and generally by the time he reaches it.

A school has been established by the War Department at Fort Monroe, Va., for the purpose of instructing soldiers in the regular army in the application of electrical machinery used in the army. The rules, published by direction of the Secretary of War, provide that an applicant must be under 25 years of age, qualified as a gunner, a student of a correspondence school or the owner of electrical books, and no applicant will be recommended unless he has sought for a year or more to become practically familiar with one or more classes of electric machinery or with some portion of the elementary literature on electricity.

A contemporary publishes a paper giving details as to the way in which freight traffic is managed in three German cities—Gera, Frost and Spremberg. They are not large places, but industrially very active, especially in textiles. The power used on the street railways is electricity or steam; the freight is transferred at the station on to smaller trucks, or the railway cars are taken over the town lines. At Frost, there are three morning and three afternoon deliveries. At Gera, perambulator cars, with flangeless wheels apart from guide wheels, have been tried with indifferent success. All these plants have been worked with a profit for several years, and though people have grumbled, the utilization of street railways for the freight traffic has points which can not be dismissed without due consideration.

The Grievances of Inventors.

TO THE EDITOR OF ELECTRICAL REVIEW:

Under such caption the New York *Times* editorially pitches into a class of citizens who deserve far better at the hands of a great modern newspaper. The editor defends the patent practice, both of the patent office and the courts, pats the officials of the former nicely on the back and deliberately slaps the faces of the poor inventor and his attorney. Yet it seems unjust to utter such a tirade of nonsense against the inventors, a class of men without whose efforts in the past this country would probably be a very small factor in the modern world. The press room, type room and other paraphernalia of the *Times* are the best evidences of the fact.

If the *Times* and other great and influential newspapers would only inform themselves carefully of the facts, they would unite in a crusade which would speedily bring about the few great reforms in our patent system which are needed in reality. The patent laws are in general excellent, and the less tinkering with them the better. It is in the patent office and in Congress that reform and real American liberality are called for.

When we want information from the governmental departments where no fee is charged and circumlocution is rampant, we sit down and wait. But when we are told by the government that we must pay, and pay heavily, for inquiry into an alleged invention in the Patent Office, we have a right to rapid transit, and the plain duty of Congress is to put an end to the wearisome delays and obstacles which beset the path of the would-be patentee. It can be done by an almost insignificant increase of the appropriation. Let the Commissioner of Patents utilize the annual surplus earned by the Patent Office in continuous betterment of the whole system. Let him engage a larger force of examiners, pay better salaries and weed out those who, from one or another idiosyncrasy, are notoriously incompetent, either in knowledge or disposition, to do decent justice to the unfortunates who come suppliant before them.

Commissioner after commissioner has made the chief feature of his annual report to Congress this crying want; has pointed out the shame of the situation, has asked for appropriations adapted to work the real reforms, but in vain. Millions upon millions are regularly granted to the War and Navy departments, genuine American liberality is shown in pensions, in rivers and harbors, post offices and other buildings, subsidies and a hundred other objects, yet there, in our beautiful capital city, is a rookery for the inventors, a fair and sightly building outside, but inside about as well adapted and equipped for its real work as an East Side sweatshop is for the production of the *Times*. A technical library is there, which, instead of being beyond comparison, is a disgrace to a village lyceum.

The inventors pay for all they get and more, and are entitled to the respect and hearty good will, rather than the criticism of the *Times*. The average examination of an ordinary application for a patent, with the writing of letters and one or more rejections, occupies an examiner's time possibly to the extent of 24 hours all told. Yet the poor applicant has to pay either $15 or $35 for it and then seldom gets the job done inside of from four to six months. The wonder is that we have any inventors at all, and we would not have them but for the inherent and unquenchable tendency of the American to improve.

If the New York *Times* will take an active part in persuading Congress to repair the great wrong it has done the inventor and appropriate liberally for the Patent Office, it will be lending a hand where it is sorely needed, and will earn the everlasting gratitude of a very large class of intelligent men.

INVENTOR.

New York, August 28.

Southern Freight Rates.

The Merchants' Association, of New York city, has consulted its counsel, Mr. Arthur J. Baldwin, of the law firm of Dill, Bomeisler & Baldwin, who is acting for Mr. Dill during the latter's absence in Europe, concerning the rights of shippers who are members of the Merchants' Association, under the new classification of the Southern Classification Committee, effective over all the roads in the South operating south of the Ohio River and east of the Mississippi River, including the steamship lines from ports within that territory to New York.

Mr. Baldwin advises the Merchants' Association that it has a sufficient cause of action on the ground of the reasonableness of the rates, and has advised that action be brought in the name of the Merchants' Association against some one road in southern territory, on some specific item affected by the new classification, and that the action be brought without delay before the Interstate Commerce Commission, at Washington. In accordance with this advice, papers in the proposed proceedings are being prepared, and will be filed at the earliest possible date.

The Southern Classification Committee promulgated a classification which went into effect June 1 of this year, which was an advance in rates, through a comparatively new system of classification, having a direct effect upon some 1,700 articles, set forth in the schedule of this Classification Committee. At the time this new classification was promulgated, the Merchants' Association, of New York, protested against it, claiming that it was a departure in the principles of classification which would work great harm to shippers in New York and elsewhere in the north, not only by raising the rates unduly, but by widening the difference between carload and less than carload rates, and would act as a prohibitive to shipments in many instances, thereby lessening the area of distribution.

After the argument was submitted, considerable correspondence ensued. Subsequently, the Southern Classification Committee held a meeting at the Chicago Beach Hotel, Chicago, Ill., early in July, at which the Merchants' Association was represented by Mr. J. M. Langley, of its staff, who has charge of these matters for the association. Mr. Langley again argued orally on behalf of the position taken by the association, and filed a written statement, giving details covering the points made by him in his argument. At that time he asked that the Southern Classification Committee reach a conclusion on the matters at issue before it, not later than August 1.

Just prior to the first of August, Mr. Langley received a letter from Mr. P. J. McGovern, chairman of the Southern Classification Committee, in which letter he took exception to the line of argument adopted by the Merchants' Association, but no conclusion was stated beyond the general statement that the committee would be very glad, at any time, to hear arguments on any specific case. Inasmuch as the new classification affected some 1,700 different articles, such a position on the part of the Classification Committee did not seem to be a reasonable one.

The Southern Classification Committee held another meeting after that, at the Oriental Hotel, at Coney Island. Mr. Langley, on behalf of the Merchants' Association, asked, in a letter, that the correspondence and specific points made by the association, through him, be taken up and passed upon at that meeting. Nothing has been heard, however, since that date. The time is now approaching when business is increasing through the number of buyers who are in New York from all parts of the country, and shippers claim they are being very seriously affected by reason of these changes which have been made in the southern classification. On their behalf, therefore, the Merchants' Association has taken this step, and will follow it to a conclusion.

A New Insulating Compound.

Some interesting tests were conducted last week, by Dr. Louis Duncan, at the factory of the Safety Insulated Wire and Cable Company, New York city, upon a new insulating material of a plastic character applied to the surface of a wire. The wire used in the experiments was of soft-drawn copper, No. 4 B. & S. gauge, and was covered with the insulating material in a manner similar to the construction of an ordinary weatherproof wire. The work of making the wire had been done by hand, and necessarily the piece tested contained numerous imperfections which would not have been present in a piece of machine-made material. The insulating covering was surrounded by lead in the usual way in order to facilitate the test.

It is possible, in the well-equipped laboratory of the Safety Company, to subject wires under test to large alternating-current pressures with various graduations. The test commenced by the application of an alternating potential of 1,000 volts, this being rapidly increased by steps of 1,000 volts up to 20,000 volts; at this point the pressure remained constant for five minutes and was increased by steps of 1,000 volts until 25,000 volts was reached. At the latter pressure the insulation remained under strain for five minutes longer and the pressure was then increased by small steps until the wire broke down at about 25,600 volts. The break was in a joint and it is believed that had the insulation been applied by machinery, under an even pressure, that about 45,000 volts could have been withstood. The covering of the wire was about one-quarter inch in average thickness.

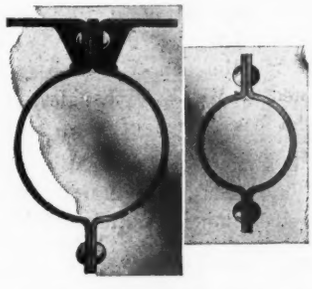


FIG. 2.—SECTIONAL VIEWS OF A PRESSED STEEL TROLLEY POLE.

A second piece of wire similar to the first and 20 feet long, but containing 20 joints in the insulation, did not break down until 10,000 volts was reached, when one of the joints gave way. The wire being cut at this point the longer portion was again subjected to pressures up to 20,000 volts before breaking down.

It is stated by those interested in the new insulation that a wire capable of withstanding a constant pressure of 100,000 volts alternating may easily be made. It is claimed that the cost of the insulating compound is very low, being about three per cent of that of the rubber compounds. It is claimed to be acid and waterproof, and easily manipulated, while the materials of which it is composed are known to have withstood the ravages of time for over 150 years. In its various forms the compound is applicable to a large number of purposes in the electrical arts.

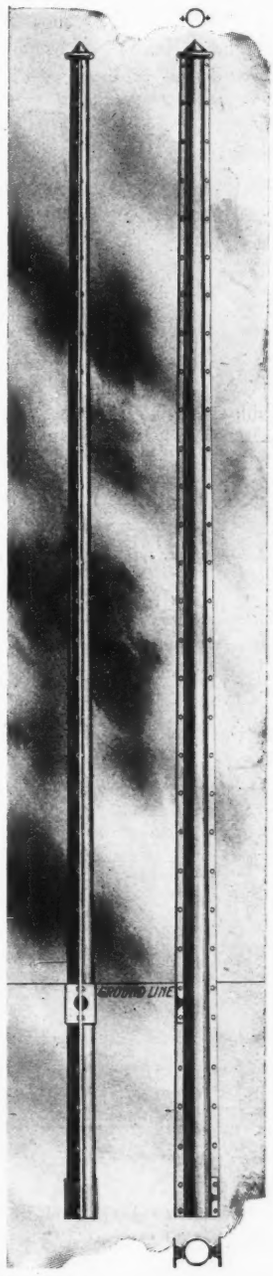


FIG. 1.—A PRESSED STEEL TROLLEY POLE. SIDE AND EDGEWISE VIEWS.

A Pressed Steel Trolley Pole.

After numerous experiments, carried on for a considerable period of time, the Pressed Steel Car Company, of Pittsburgh, Pa., has begun to manufacture pressed steel trolley poles. The design is believed by the manufacturers to be an acceptable one from the standpoint of construction along theoretical lines and ultimate strength. The details are practically those of the old style pipe trolley pole with the additional advantage that the first cost is less than that of the present style. Secondly, it is thoroughly riveted together, making it practically a one-piece device and thus creating a maximum standard of strength throughout its entire form. This latter characteristic is said to be lacking in the ordinary trolley pole which exceeds 20 feet in length. These are usually made in two pieces, involving a joint. In the third place the new pressed steel trolley pole is very attractive in its appearance and general make-up, as can be judged from the accompanying illustrations. Another advantage which this new trolley pole is claimed to have is the strengthening feature that is added to the pole at the ground line. A reference to the illustrations will clearly indicate this. The pole consists of two pieces of steel, each semi-circular in form, with a flange on each side. The two halves are placed together and thoroughly riveted to the flanges just below the ground line; a bracket is placed on one side where the bottom of the pole rests on the earth and another is placed on the opposite side, thus giving the greatest possible resisting force. At the top of the pole there is a covering made in the form of a malleable iron cap, which, however, can be made of cast-iron if desired. The Pressed Steel Car Company is prepared to turn out poles of any length between 24 and 40 feet.

Automobile Races at Newport.

Newport, R. I., is to have the much talked of automobile races after all. Mr. William K. Vanderbilt, Jr., who has been advocating the races, went out to Aquidneck Park when informed of the decision of the Police Commissioner refusing permission to race on the Ocean Drive, and after an inspection of the track there decided that it was better than nothing, and arrangements will now be made for the races. The track is a half-mile one, and wide enough for three automobiles to race abreast. Mr. Vanderbilt will offer money for purses for the races and will enter his French machine if he can get anything to race against it.

ELECTRIC RAILWAYS

The Battle Creek, Mich., common council has granted a franchise through the city to the Battle Creek & Coldwater Electric Road. The road has now been granted the right-of-way the entire distance between the two cities.

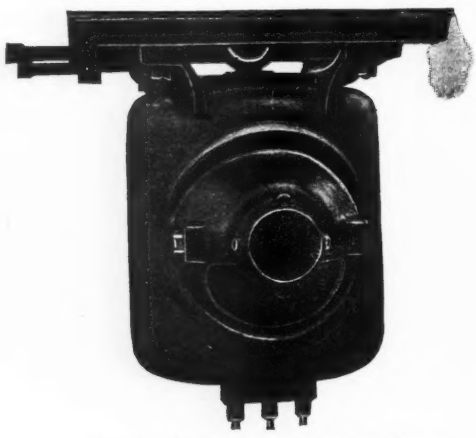


FIG. 1.—AN INVERTED BIPOLAR POWER MOTOR.

The town trustees of Morristown, Ind., have granted a right-of-way to the Indianapolis, Morristown & Rushville Electric Railway Company for a line to Morristown from Indianapolis. Work is to be begun in six months.

The directors of the Haverhill & Southern New Hampshire Street Railway have filed a certificate of incorporation. The line is to be six miles long and run from Haverhill, Mass., to Salem, N. H. The capital stock will be $60,000, par value of shares, $100.

Surveyors are at work making preliminary surveys for the proposed Milford, Mass., Mendon & Uxbridge Electric Railway. These surveys are necessary to get plans for presentation to the authorities of the several towns interested, when applying for a franchise.

The selectmen of Millbury, Mass., have voted to grant a franchise to the Worcester & Blackstone Valley Street Railway Company to extend its track to Worcester, a distance of six miles. The line is to be built this season, and will give the company a through line from Worcester to Whitinsville, 15 miles.

The council of Ripon, Wis., has acted favorably on the petition of Chicago capitalists for a reasonable franchise for the construction of an electric line from that city to both the north and south shores of Green Lake, and from the south shore of Markesan. A franchise will soon be granted and the line will be ready for use by next Spring.

Citizens of Wabash, Ind., who, last May, voted a subsidy of $22,000 in aid of the Wabash-Peru Interurban Line, projected by New Haven, Ct., capitalists, are now elated over the positive assurance that the road will be constructed without delay. A $10,000 bond is being prepared, obligating the syndicate to begin work in six weeks and complete the road by January, 1901.

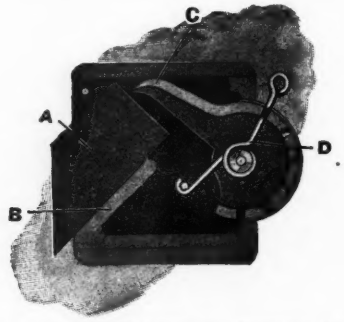


FIG. 2.—BRUSH HOLDER OF BIPOLAR POWER MOTOR.

A company of Cleveland, Ohio, and Akron capitalists are about to build a road from Springfield to Columbus. The company hopes that, in the near future, it will be able to unite Cincinnati with Columbus by means of the Dayton & Cincinnati and the Dayton & Springfield lines. Will Christy, president of the Southern Ohio Traction Company and vice-president of the Northern Ohio Traction Company, is said to be at the head of the deal.

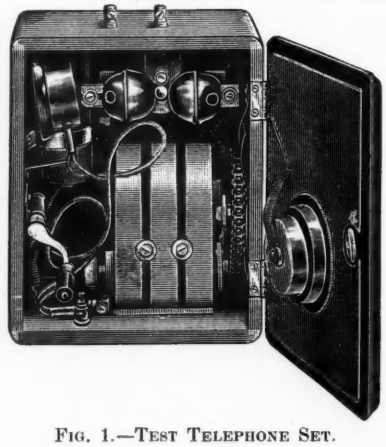


FIG. 1.—TEST TELEPHONE SET.

Bipolar Power Motors.

The illustrations herewith show an inverted bipolar power motor and its brush holder as manufactured by the Paragon Fan and Motor Company, of New York city. The manufacturers have devoted especial attention to the details of design in these small machines which are usually expected only in motors of the larger sizes. Eighteen standard sizes are built, giving a range from one-twentieth horse-power, at 1,650 revolutions per minute, to one and one-half horse-power at 1,800 revolutions per minute. These sizes are divided into three series. The ratings are conservative to carry reasonable overloads and insure cool running, yet the proportions of the machines are such that the cost and weight are not excessive nor is the machine underloaded at normal output to such an extent as to lead to a sacrifice of efficiency.

In Fig. 2 is shown a sectional view of the type of brush holder used in the larger sizes of Paragon power motors. It is known as "inclined plane" brush holder, in which a triangular brush is held between an inclined surface and a pressure finger, their combined action serving to force the brush firmly against the commutator so that while it is entirely free and can not stick, still it is so held as to overcome any tendency to "chatter." There are numerous detailed advantages in these power motors, all of which are described in bulletins which may be obtained free on request.

Recent Telephone Apparatus.

The desk telephone set illustrated herewith, is somewhat of a departure in telephone apparatus, its features being that it is self-contained instead of having the generator apart from the standard. The instrument consists of a generator and induction coil, oxidized base and receiver switch, a transmitter handsomely nickeled, and a strong double-pole receiver.

FIG. 2.—DESK TELEPHONE SET.

Fig. 1 shows a test telephone set, a newly constructed portable telephone made by the Central Telephone and Electric Company, St. Louis, Mo., also makers of the desk set just described. This test telephone is a complete instrument with generator, ringers, transmitter, receiver, induction coil, and batteries all in a strong oak box with a strap for facilitating the carrying.

Some New Multipolar Generators.

During the past year there has been placed on the market a new line of motors and generators, which, from their novel design and excellent performance in service, have attracted considerable attention. Figs. 1 and 2 give a good idea of the general appearance of these machines. They are of the multipolar type, and are manufactured in sizes from 5 to 40 horse-

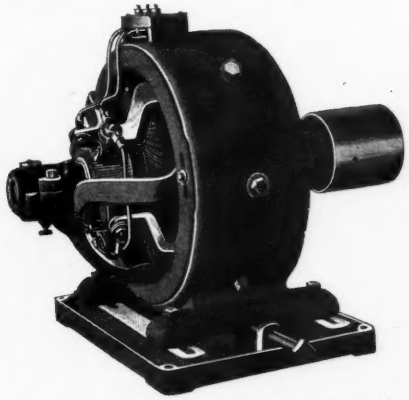


FIG. 1.—SEMI-ENCLOSED MACHINE, 5 TO 40 HORSE-POWER.

power, inclusive. The distinguishing feature is in the method of supporting the armature. Instead of the ordinary end plates or pedestals independently bolted to the field magnet or base, the armature in this type is carried by a single casting or yoke, which slides into and is bolted to the field ring. The result is absolute alignment of the bearings, and a distribution of metal giving the maximum strength for given weight.

The three broad supporting seats form a perfect centering device. These seats are provided with slots for the holding bolts, so that the yoke and the armature have a certain amount of longitudinal adjustment. This is a very valuable feature, as the armature may be accurately centered under all conditions of service without interfering with the free end play or destroying the absolute interchangeability of the bearing sleeves or end-thrust shoulders.

The supporting yoke is turned to the same diameter as the interior of the field ring, and it may be interchanged with the field magnet cores, so that the motor may be placed at any angle, or, if the motor is to be bolted to the ceiling, the yoke and armature is simply pulled out from the end of the machine, as shown in Fig. 2, and replaced in an inverted position, when the machine is ready to be set up.

The armature may be removed from either end of the machine by simply loosening the bolts and pulling the yoke out in either direction.

The brushes are of an improved box type, and are carried on a light but stiff ring, fitted to the inside diameter of the field ring, thus dispensing with the usual brush yoke, and leaving the front bearing unobstructed.

The best modern practice is followed in the other details. The armature is of the ventilated ironclad type. The coils are machine wound and interchangeable. The shafts are removable in the larger sizes. Protecting shields for the end of the winding are used. Mica insulation, with other high grade material, is used in both fields and armature, and the average insulation resistance exceeds two megohms. The speeds are low in various sizes, and the careful proportion of the magnetic circuits and electrical details insures a fixed and sparkless commutation and quiet running under all conditions of load.

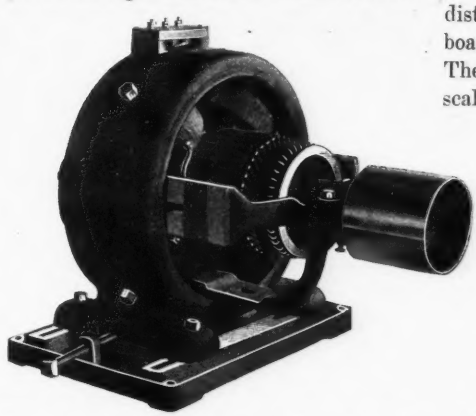


FIG. 2.—MACHINE SHOWN IN FIG. 1 WITH YOKE AND ARMATURE PARTLY REMOVED.

These machines are made in sizes from 5 to 40 horse-power, multipolar, and one-quarter to seven and one-half horse-power, bipolar, dustproof or semi-enclosed, as may be desired. Fig. 3 shows the latter type, which embodies the same novel features as the multipolar style. Detailed descriptions of these machines are given in bulletins, which will be sent on application to the manufacturers, the New England Motor Company, Lowell, Mass.

The city council of Galesburg, Ill., has decided on building a municipal electric lighting plant, and has let the contract, with the promise that the plant is to be completed in 90 days. This action largely resulted from the local company some time ago threatening to cut off city lights unless the city should accept its proposition.

"What's the difference between knowledge and wisdom?"

"Well, it takes knowledge to build an automobile, but it takes wisdom to run it."—*Chicago Record.*

Electric Power Transmission at the Paris Exposition.

[*From The Mechanical Engineer, Manchester, England.*]

The central point of interest in the Paris Exhibition to an engineer is the absolute triumph of electric lighting and power. Herein it differs from all previous exhibitions, and is the crowning glory of the last year of the nineteenth century, the beginning of which was marked by the invention of Volta's pile. Here at Paris there are no main belts or ropes used for the transmission of power. Engines drive direct to generators, mostly of the fly-wheel type, and the current is supplied at varying pressures for light and power to all parts of the exhibition, to areas adjacent, and to others a mile away. Power generation is just centralized in the boiler shed, in the groups of engines adjacent, and in the Palace of Electricity, and all distribution is effected in the switchboards in the rear of the Chateau d'Eau. These arrangements, made on so vast a scale, and studied by engineers from all

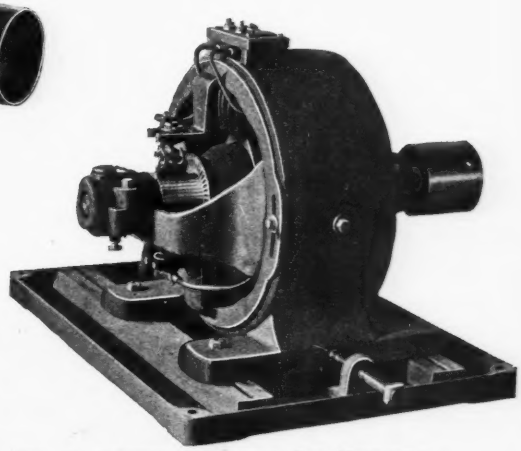


FIG. 3.—ANOTHER TYPE OF SEMI-ENCLOSED MACHINE, ¼ TO 7½ HORSE-POWER.

parts of the world, are full of significance. They mean probably that the practice of belting engines to dynamos for large installations at least will disappear in favor of the direct-coupled generator. They mean, also, that belts and ropes for mill drives will be employed less, and the electrical conductor more. And after all, this will be only an extension of the revolution that is going on in the driving of short lines of shafts and of individual machines by motors instead of by belts. It is impossible for any one to observe the installations of electric power at Paris without feeling that this is destined to be the method of the future. True it is that it is the Swiss, the French, American and German, and not so much the English. But the English visitor had better leave insular prejudice behind, otherwise it will receive some hard knocks in Paris.

A Recharging System of Automobile Motors.

The illustrations herewith represent a new departure in automobile motors which are designed not only to operate in driving the vehicle but also in making use of gravity in descending grades after recharging the battery. The motor itself is shown in Fig. 1 and is of the enclosed dust and water-proof type having a cast-steel magnet-frame with the ends turned inward to protect the field coils. To the cylinder thus formed is bolted at each end one of the yokes carrying the bearings. By fitting these yokes to a shoulder turned in the end of the magnet frame alignment is naturally secured without difficulty. The yoke shown on the right-hand side of Fig. 1 carries in addition to its bearing the rocker arm and brush holders. Over this part of the yoke is provided a light, conveniently shaped aluminum cover so as to allow easy access to the commutator and brushes. The motor is provided with ball bearings and is of the four-pole type, having laminated pole-pieces of peculiar shape, designed to give uniform distribution of magnetic flux over the air-gaps. The armature is barrel-wound and the brush holders are of the reaction type, carrying graphite or carbon brushes.

FIG. 1.—MOTOR USED WITH A RECHARGING AUTOMOBILE SYSTEM.

The maker of this motor, the Lincoln Electric Company, of Cleveland, Ohio, is manufacturing the ordinary type of series motor but in addition makes this type for which it claims extraordinary performance on account of its capacity to recharge the storage battery on down grades. Whenever the carriage is reduced in speed from the third speed to the second speed, or from the second speed to the first speed, or when it is running down hill, the motor operates as a dynamo and is properly connected by means of the controller to the batteries in such a way that it effectually recharges them.

In a carriage having speeds of four, eight and sixteen miles per hour it is claimed that, when descending a gentle grade at a speed of about five miles per hour, the batteries will be charging at the rate of from 10 to 25 amperes, depending on the weight of the carriage and the steepness of the grade.

It is also claimed by the maker that the efficiency of this motor, especially at light loads, is very high. It is well known that even going down grade the series motor of the ordinary type absorbs considerable power, but it is claimed that this motor does not use so large a percentage of power when doing light work and that when the carriage is running freely down hill it not only uses no power but actually restores power to the accumulator. Thus, under a given charge, and with good cells, the vehicle equipped with it will run considerably further than one carrying the old style series motor.

The change from the operation of the machine as a motor to a dynamo is entirely automatic and is made by the controller shown in Fig. 2. This controller gives three speeds forward and two backward and is entirely self-contained and automatic in its action. Fig. 3 shows a carriage designed by the makers of these motors and equipped with the system described above.

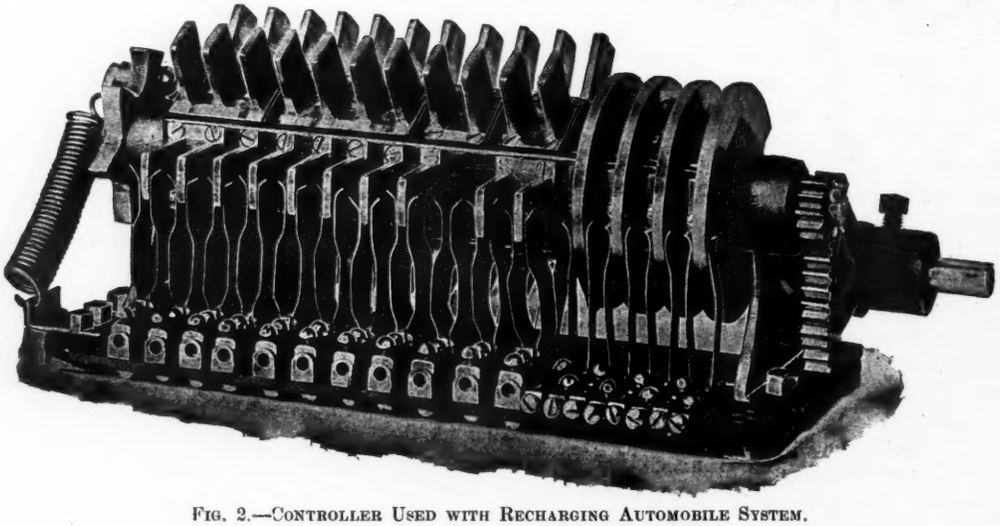


FIG. 2.—CONTROLLER USED WITH RECHARGING AUTOMOBILE SYSTEM.

Carthage will soon be the centre of the strongest interurban telephone system in Missouri, as arrangements have been made to connect the Pierce City lines, recently purchased by T. J. Hyman, of Chicago, with the Springfield and Monet and the Pierce City and Reed's line with the Carthage exchange. When completed the accommodation afforded the mining regions will not be surpassed anywhere.

AUTOMOBILES

Mr. A. R. Shattuck, chairman of the exhibition committee of the Automobile Club of America, states that all the floor space for the automobile exhibition in Madison Square Garden, New York city, November 3 to 10, 1900, has been taken by intending exhibitors, and the demand for space has been so great that it has been decided to floor over the boxes on the north side of the Garden, and also to exhibit automobiles in the restaurant. The following manufacturers will exhibit their products: The National Automobile and Electric Company, Riker Motor Vehicle Company, Winton Motor Carriage Company, F. A. LaRoche & Company, De Dion-Bouton Motorette Company, United States Automobile Company, L. M. Harris, The Autocar Company, Foster Manufacturing Company, Automobile Company of America, Woods Motor Vehicle Company, Stanley Manufacturing Company, Locomobile Company of America, Canda Manufacturing Company, American Electric Vehicle Company, Daimler Manufacturing Company, Waltham Manufacturing Company, American Bicycle Company, Electric Vehicle Company, Overman Auto Company, The Knox Auto Company, Holyoke Auto Company, Jos. Dixon Crucible Company, Diamond Rubber Company, Rose Manufacturing Company, Consolidated Rubber Tire Company, Gleason-Peters Air Pump Company, Goodyear Tire and Rubber Company, Dow Portable Electric Assistant Company, Charles E. Miller, Veeder Manufacturing Company, B. F. Goodrich Company.

FIG. 3.—ELECTROMOBILE EQUIPPED WITH RECHARGING SYSTEM.

One "R. G. P." writes to the *American Machinist* as follows: "Perhaps you had noted a diversity of opinion as to the proper name to be given to a self-propelled road vehicle. You have heard it called autocar, autobain, motor car, motor carriage and automobile, but I think that about the most expressive term I have heard yet was used by my wife the other morning, when she gave me a knowing, sidewise glance and remarked, 'Robert, I guess they made you steer the automobilly-goat last night; didn't they?' I couldn't say a word."

It is announced that the Bellechasse, Quebec, Telephone Company, which amalgamated some time ago with similar companies in the Quebec district, has now concluded a new amalgamation with the Merchants' Telephone Company, of Montreal. It is understood that the Merchants' Telephone Company will extend its line as far as Three Rivers, while the Bellechasse Company will stretch its wires down to Rimouski, where it will join the Metis Company, whose line is to extend as far as Campbellton.

Chinese Automobiles.

[*From the American Machinist.*]

Our esteemed contemporary, the ELECTRICAL REVIEW, says, in effect, that the adherence, in automobiles, to the forms of the horse-drawn vehicle results from the "Chinese habit of thought" of the designers thereof, and says: "If anybody can assign any reason whatever why an automobile should look like a horse vehicle without a horse, now is the time for him to speak." Whereupon we venture to say that the obvious reason is that no one has as yet proposed a better form, or one that does not "look like a horse vehicle without the horse," and yet is adapted to the service it is to perform. And we venture further to remark that anyone who calls our inventors and designers of automobiles Chinese thinkers thereby inevitably suggests a query as to what he himself hath done to show us a better or less Oriental manner of thinking on that subject.

We are not of those who think that no one has a right to suggest the possibility or need of improvement unless he is prepared to show plans and specifications—to criticise a pudding unless he himself can tell the cook just how to make a better one; but it would seem as if those who happen to have access to pens, ink and types ought first to secure an engraving of an automobile design thought to be better than those that now afflict their vision, and to print this along with their remarks about Chinese habits of thought.

A Sumptuous Catalogue.

The Brown Hoisting and Conveying Machine Company, of Cleveland, Ohio, has just issued a remarkably excellent catalogue describing its well-known handling and conveying apparatus. The catalogue is 9 by 12 inches in size, is handsomely bound in canvas and illuminated in gold. The illustrations are of the highest grade of half-tone reproduction and are printed on tint blocks, thus adding very much to their effectiveness. It is very evident that nothing has been spared to produce the best possible work, and the result amply justifies the expenditure of time and money.

PERSONAL.

Mr. Paul W. Bossart, who, for the past five years has been connected with the American Electric Telephone Company, of Chicago, has resigned to accept a position with the Kellogg Switchboard and Supply Company, of Chicago. Mr. Bossart, who will have charge of one of the Kellogg Company's departments, has had a wide practical experience in telephone and other electrical work and is well known in electrical circles throughout the country.

The New Underground Electric Railway in London.

United States Consul-General Osborne writes from London as follows:

The new electric underground railway, in London, has occupied four years to construct and cost £3,500,000 ($17,032,850), the cost per mile having amounted to £580,000 ($2,802,670). The line runs from the Bank of England, in the centre of the city proper, to Shepherds Bush, a distance of six miles, and between those points there are 11 stations, making 13 in all. The fare for the whole or any distance is 2d. (4 cents). The diameter of the tunnels, or tubes, is 11 feet 6 inches, and at the stations 21 feet. The stations are all higher than the level in the tunnels, the object being to gain a natural aid in checking the speed upon entering the stations.

The line was opened on July 30, and has proved an immediate success. Many American innovations have been introduced in the general working and are appreciated by the passengers; the announcement by the conductors that the "next station will be ———," while amusing many, is much welcomed. The introduction of "choppers"—an arrangement whereby the possible loss of the passenger's ticket is obviated—is also likewise appreciated.

The success of the new railway will have immediate effect on the old underground lines, the sulphurous fumes in which have long been matter for comment and discontent.

Another point in favor of the new undertaking is that, as there is but one fare, the grades or classes (first, second or third) of carriages, and consequent distinction of passengers, is eliminated.

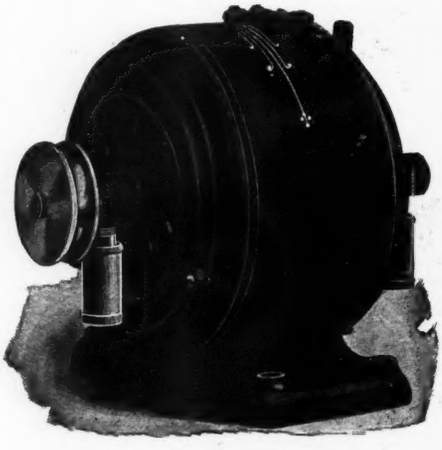
The newspapers call attention to the fact that the new system has not only emptied the omnibuses, but has actually thinned out the crowds on the pavement. During three days, 260,000 passengers used the railway. They predict that in 10 years London underground will be a vast network of electric railways. Already there is projected a grand belt of electric lines to encircle the metropolis, with intersecting railways to join the north and south.

The luxurious vestibule cars, of which the company has 190, cost £1,000 ($4,866) each, and the 28 torpedo-shaped engines were built in the United States for £3,000 ($14,599) apiece.

The working expenses of the line are calculated at £150,000 ($729,975) per annum, and it is estimated that if a fair dividend is to be earned 40,000,000 passengers must travel on the railway in the year. That represents a daily average of 110,000. It is believed that this will be easily reached within the near future.

Protected Type Direct-Current Motors.

The illustration represents a motor of a new type designed for very small power uses where machines ranging from one-sixteenth to one-sixth horse-power may be used. The same care that is exhibited in the construction of larger motors has been expended upon the construction of these small machines by the makers, the



PROTECTED TYPE OF DIRECT-CURRENT MOTOR.

Robbins & Myers Company, of Springfield, Ohio. The brush holders are of the cartridge type with automatic spring feed, the brush holder and carbon being removable. All the bearings are self-centring and have large wearing surfaces, the diameter being three-eighth inch and the bearings one and one-quarter inches long. These are all provided with automatic lubrication in the shape of a wick oiler. The commutators are built in the same way as those for larger machines, of hard drawn copper parts insulated with mica and clamped between steel collars. Grooved pulleys are generally furnished with these motors, though other types may be used. For such small machines no starting box or rheostat is necessary, but where it is desired, it can readily be attached. The motors are all series wound for either 110 or 220 volts, and are designed for speeds ranging from 750 to 2,000 revolutions per minute.

DOVER, DEL.—The Zanesville Light and Power Company, of New York city, has been incorporated; capital, $225,000.

International Association of Municipal Electricians.

As previously announced, the fifth annual meeting of the International Association of Municipal Electricians will be held in Pittsburgh, on September 25, 26 and 27. Mr. Morris W. Mead, chairman of the executive committee, who is superintendent of the Pittsburgh Bureau of Electricity, is giving much attention to completing the work of arranging for the meeting and is ably assisted in it by Mr. G. Loomis, chairman of the committee on arrangements, who is superintendent of the Bureau of Electricity of Pittsburgh's twin city across the river, Allegheny.

It is now understood that fully 300 delegates, many accompanied by their families, will attend the convention. Delegates intending to be present should notify Mr. Mead or Mr. Loomis at what time and upon what train they will reach Pittsburgh so that members of the committee may be at the station to meet them and escort them to their hotels. A ladies' reception committee has been formed, Mrs. H. P. Ecker being chairman. This committee will arrange for the reception and entertainments to be given the ladies in attendance at the convention.

It is expected that railway companies will arrange to issue tickets on the certificate plan for one and a third fare from all points. Among the entertainments already arranged for will be a trolley ride on special cars of the various traction companies in Pittsburgh, on the afternoon of the first day. Luncheon will be served during this trip at Kennywood Park. An excursion and banquet on the steamer Mayflower has been arranged for the evening of the 27th.

Telephone Material Wanted

The Clark Automatic Telephone Switchboard Company, 938 Banigan Building, Providence, R. I., is in the market for telephone material and would be pleased to receive catalogues from manufacturers and dealers in that class of product. This company has recently been organized to manufacture an ingenious automatic telephone switch system and has already put out several of its instruments which have met with high favor.

Henry Altemus Company, Philadelphia, will issue about September 15 a volume of poems by Mr. William J. Lampton, known wherever newspapers are read by his peculiar form of zig-zag poetry in the New York *Sun*. The volume will appear under the title of "Yawps and Other Things." It will be bound in full cloth and sold for $1 per copy.

TELEPHONE AND TELEGRAPH

It is reported that W. K. Vanderbilt has acquired large interests in Western Union and will endeavor to bring about a consolidation with Bell Telephone. Russell Sage denies the report.

FIG. 1.—DIAL FOR AN AUTOMATIC TELEPHONE SWITCHBOARD.

The Binghamton, N. Y., Telephone Company is making active preparations for starting work next week. After the filing of the bond for $10,000, which the company is required to give to the city 10 days after the mayor approves the resolution recently granted by the council granting the company an extension of time, the work will be begun. The company expects to push the work and have the system installed and in working order long before the expiration of the time limit.

An innovation in France is the establishment of hot and cold baths in the largest telephone offices in Paris. One of the ministers was told that constant telephoning was extremely hurtful to the nervous systems of the women operators, and, taking a physician with him, went to investigate. Finding the complaints were well founded, he referred the subject to a commission, who recommended shorter hours and the introduction of baths as sedatives. The bath costs a few centimes, however.

The officials of the American Telephone Company are not as yet prepared to state publicly the amount of deposits of American Bell Telephone stock for exchange into that of the American Telephone and Telegraph Company. A prominent Boston banking house, however, which is identified with telephone interests, in a recent private letter to its customers places the amount of American Telephone stock now outstanding at about $90,000,000; the authorized issue is $100,000,000. The market value of the collateral underlying the four per cent bonds of the American Telephone Company is declared to be 33 per cent in excess of the par value of the bonds issued.

Kansas City, Kas., will probably have a telephone fight on its hands soon. At the last meeting of the city council the

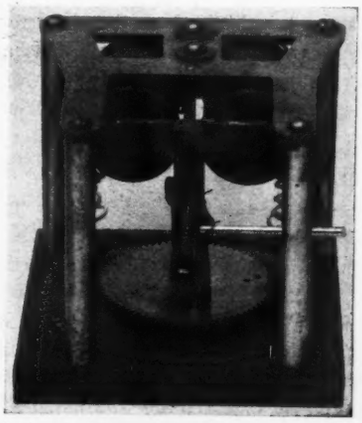


FIG. 2.—75-STATION AUTOMATIC TELEPHONE SWITCHBOARD.

city's legal department was instructed to draft an ordinance annulling what is known as the A. E. Snelling franchise. This franchise was granted by the council during Mayor Twiss's administration, in April, 1897. It purported to be a franchise for a fire alarm system, but later developments showed that it was a franchise for a telephone system of 20 years duration. It was railroaded through the council the night it was introduced without being referred to a committee, although five councilmen objected to it. The only reason given for passing it in such haste was a communication from the National Fire Underwriters' Association, complaining of the inadequate fire protection. No fire alarm system was ever put in. The original Bell telephone franchise expires September 18, 1900. There is doubt as to whether the council has power to annul the franchise at this time.

A New Automatic Telephone Switchboard.

An ingenious telephone switch and its application to telephone instruments is shown in the accompanying illustration. The dial shown in Fig. 1 shows as many numbers or points as there may be telephones in a small exchange or intercommunicating system. The dial may be turned to the number wanted, at which it stands until it is released by pressure on a button at the side of the dial base. This releases spring-driven machinery, which sweeps a contact back over as many numbers as have been passed from the zero position of the dial. This spring is connected in circuit with a storage battery and magnets in the automatic switchboard at the exchange office. The operation of the switchboard apparatus may be clearly seen from Fig. 2, which shows a 75-instrument exchange switch. The impulses coming in from the dials at the subscriber's instrument moves the ratchet wheel carrying the contact around in step with them so that finally a contact carried by it rests upon the desired connection. The instrument can be adapted to a large variety of uses and is said to work very efficiently in practice. Fig. 3 shows the system as it is installed at Storm Lake, Iowa, connected with a long-distance line. The

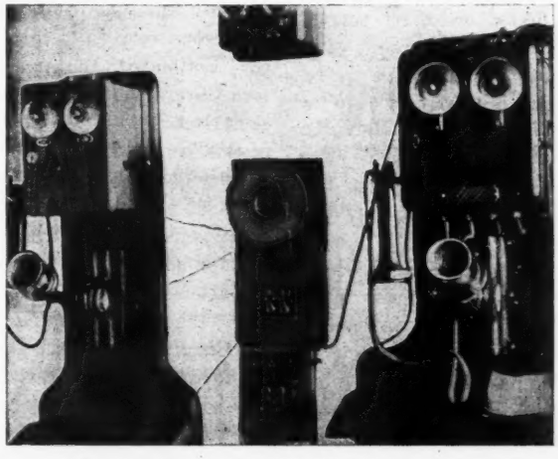


FIG. 3.—AUTOMATIC SWITCHES APPLIED TO LONG-DISTANCE TELEPHONES.

apparatus is manufactured by the Clark Automatic Telephone Switchboard Company, of Providence, R. I., and has already been put in use in a large number of factories, small exchanges and other places where an automatic system is highly desirable.

Five prominent headlands between Dover and the Scilly Islands have been selected for the installation of the wireless telegraph, and masts 150 feet high are to be made at Portsmouth, England, for this purpose.

Hot Wire Ammeters.

To the Editor of Electrical Review:

I notice in your issue of July 4, 1900, an article on Electrical Measuring Instruments, by J. Franklin Stevens, this article having been delivered before the Franklin Institute of Philadelphia.

I wish to call attention to some of Mr. Stevens remarks concerning hot wire instruments which I think need some modification. I quote Mr. Stevens' article as follows: "As a shunt ammeter the hot wire instrument is a distinct failure, for, while the manufacturers claim it can be operated on .3 volt drop for full scale, my personal experience has shown a drop of 6 volts to be necessary." I do not know how much experience Mr. Stevens has had, evidently not as much as some other people, for hot wire ammeters with shunts have been and are being made every day that require even less than .3 volt drop for full scale deflection. The Stanley Electric Manufacturing Company are making hot wire shunt ammeters from 100 ampere to 6,000 ampere capacity with an average drop of .26 volt for full deflection. We are prepared to furnish any one wishing to purchase hot wire shunt ammeters, from 100 ampere maximum to 6,000 ampere maximum capacity, a guaranteed fall of potential not exceeding .3 volt.

Again to quote Mr. Stevens: "It has been shown that these ammeters (hot wire) when calibrated on direct current are not accurate within 10 per cent when used on alternating current unless the reactance in the shunt is exactly equal to the reactance in the instrument." Here Mr. Stevens claims that the least possible error that the instrument can have from this cause is ten per cent. Such a statement is manifestly absurd.

In themselves the reactance of the shunt and the reactance of the instrument introduce no error. An error is introduced only when the ratio of the reactance voltage of the shunt to its ohmic drop is different than the ratio of the reactance voltage of the instrument and its ohmic drop.

In the April issue of the *American Electrician,* Mr. E. A. Wagner called attention to the fact, that, if the reactance voltage of the shunt was 50 per cent of its resistance drop, and the instrument had no self-induction, then the instrument might be in error to the extent of 10 per cent. I suppose it is from this article that Mr. Stevens drew his inspiration. Mr. Wagner has since explained that he merely wished to call attention to the fact that such an instrument could be made. Of this there is no doubt, if any one wanted it. In practice, such a condition is impossible, as both shunt and instrument are a part of the same circuit, and as such have their proportionate share of the reactance.

If the instrument and shunt are carefully designed, so that the ratios of reactance and resistance approximate each other, the error introduced becomes exceedingly small. In fact, in over 1,000 instruments calibrated on direct current, and checked on alternating current, I have never found an instrument in error, when the standard shunts and leads have been used.

W. J. Lloyd.

Pittsfield, Mass., August 21.

Electric Power for Indian Mines.

An important project in connection with the use of water power and electricity for supplying power to mines is being considered by the gold mines in the Colar district, in Mysore, India, says the *Engineering and Mining Journal.* The scheme is a very extensive one, for it involves the conveyance of the current for a distance of 100 miles from the generating station at the Canvery Falls. The Mysore Government is standing the cost of the installation and will charge the various companies according to the amount of power supplied. Messrs. John Taylor & Sons, of London, who are the managers of the leading gold mines in the district, have gone very fully into the subject in conjunction with the engineers of the Mysore Government, and one of their representatives has visited many installations of this kind in Europe and in America.

Over and above the well-known advantages of electric installations, it may be mentioned that there are two special reasons for adopting the system in the present case. One is that fuel is very expensive. The leading mines; *viz.,* Mysore, the Champion Reef, the Doregum and the Nundydroog, spend nearly £50,000 a year each on fuel, and many of the smaller and lower-grade properties find the fuel question a serious bar to success. The second reason is that it will be possible to dispense with a large amount of the less skilled native labor, which, at the best, is very poor. The native is a very slow worker and his pay is very small, and large numbers have to be employed in order to get the work done at all. The housing of these numbers is a constant source of anxiety to the managers and a proper sanitary discipline is hard to maintain. The advantage of the electrical system, when installed right through the mines and mills, will be enormous.

The Ohio Electric Light Association.

The sixth annual meeting of the Ohio Electric Light Association was held at the Boody House, Toledo, on August 14, 15 and 16. The first day's proceedings included the address of the president, Mr. D. L. Gaskill, of Greenville, and several committee reports. Mayor Jones, of Toledo, welcomed the delegates at the afternoon session, and, in the course of his address, committed himself unequivocally to municipal ownership. Boat and trolley rides occupied the remainder of the afternoon. The convention reassembled at 8.30 P. M. Papers were read by Mr. A. J. Stahl, of Laport, Ind., on "Two Revenues Instead of One—Electricity a By-Product," and Mr. E. J. King, of the Fort Wayne Electrical Works, on "Induction Integrating Wattmeters." Both of these papers were discussed at considerable length.

At the Wednesday morning session, Mr. J. S. Peck, of the Westinghouse Electric and Manufacturing Company, read an address describing the principles which control the action of a transformer. Mr. J. H. Perkins, of Youngstown, Ohio, read a paper entitled "The Operation of a Combined Lighting and Power Plant." At the afternoon session, Captain James M. Andrews, of the General Electric Company, Schenectady, N. Y., read a paper on "Choice of Periodicity of Alternating-Current Apparatus." This was followed by a paper on "The Desirability of Using Storage Batteries in Medium-Sized Stations," by Mr. L. G. White, of the Columbus Edison Company, Columbus, Ohio. Mr. M. E. Turner, of Cleveland, gave an informal talk on the "Two-Rate Method of Charging for Current." This was followed by a paper on "Electricity *vs.* Gas," by Mr. W. F. White, of Cincinnati.

There were more boat rides and trolley trips on Wednesday afternoon and Thursday. At the closing session the following officers were elected for the ensuing year: President, Ernest J. Bechtel, Toledo; vice-president, Samuel Scovil, Cleveland, Ohio; secretary and treasurer, J. H. Perkins, Youngstown, Ohio. The next convention will meet at Put-in-Bay, and the date will be selected later by the executive committee. Following the election of officers, Mr. H. W. Hillman's paper on "Arc Lighting" was read by Mr. White.

Corning, N. Y.—Corning Telephone Company, of Corning, has been incorporated. Capital, $1,000; directors: B. F. Hubbell, C. B. Stowe, of Cleveland, and G. N. Orcutt, of Hornellsville.

The Street Railway System of Glasgow, Scotland.

United States Consul Samuel M. Taylor writes from Glasgow as follows:

The street car system of Glasgow is owned and operated by the city under the direct supervision of a committee of the town council. The report of the year ended May 31, 1900, shows that the total length of double track operated by the city is 41 miles 1 furlong 178 yards over 42 miles 2 furlongs 161 yards of streets, making a total length of single track of 83 miles 3 furlongs 119 yards.

The gross capital expenditures for the system since 1894 (independent of operating expenses) have been $5,164,975, and the present indebtedness is $4,061,806. The capital invested is $4,559,502. Of the 41 miles of double track, five miles have electric traction, the rest being operated by horses. The total receipts of the system during the year were $2,286,850. The working expenses were $1,676,412, leaving a balance of $610,438, of which were expended some $84,000 for interest on capital, $57,501 for sinking fund, $156,096 for depreciation written off capital, etc.

One item of $60,000 consists of payments made to the general revenue fund of the city, which is in lieu of the amount which the city would receive in taxes, it is presumed, were the system operated by a private company. The balance goes into the reserve fund.

There are 3,400 persons employed, including 100 clerks. The general manager receives $6,800; the chief engineer, $2,400; the electrical engineer, $2,000, and the mechanical engineer, who has charge of the power station, $1,216. Point boys receive 28 cents per day; trace boys, from 40 to 52 cents per day; car cleaners, from 88 cents to $1 per day; drivers, conductors and motormen, from $1 to $1.12 per day. These rates apply to Sundays and week days alike.

The rolling stock consists of 384 horse cars, 132 electric cars (47 of which only are now running), 17 omnibuses, 39 lorries, and numerous carts, wagons and vans. There are 4,411 horses.

Work is now progressing with the object of changing the entire system to electric traction, which it is hoped to have completed within the next 18 months. No underground conduits will be used, according to the present plans.

Fares range from one cent for first half mile to two cents for a mile; the longest ride is six miles, costing six cents. No transfers are issued, and tickets are not used.

The committee of the town council having supervision of the tramways receives no compensation. For that matter, however, no member of the city government of Glasgow, including lord provost, town councilors and bailies (police judges), receives compensation.

The city of Glasgow has a population of about 850,000 and spreads over an area of nearly 12,000 acres.

There are no electric or other tramways extending out of Glasgow to other towns or cities. Within the city is an underground cable road which makes a circuit of about five miles and is owned and operated by a private company. The rate of fares on this road is about the same as that prevailing on the surface roads.

The German Rubber Trade.

Mr. Oliver J. D. Hughes, United States Consul, at Coburg, Germany, makes the following report to the State Department.

Germany's import of crude rubber and gutta-percha in 1899 amounted to 139,164 metric hundredweights,* representing a value of 75,000,000 marks ($17,850,000) and an increase over the year 1897 of about 40 per cent in bulk and of about 50 per cent in value. The exports of raw materials amounted to 54,329 metric hundredweights, estimated at 3,000,000 marks ($714,000). Russia imported more crude rubber than Great Britain and five times as much in 1899 as in 1898. The United States received very large quantities of crude rubber—three times as much as in the preceding year. The official statistics comprise under raw materials old and waste rubber. Germany gets rid of a good deal of its old rubber, and the United States does not appear to mind buying shoddy.

The imports of finished rubber goods consists chiefly of threads and plates, shoes and textile fabrics impregnated with rubber.

The ordinary preparation of seamless rubber wares, by applying successive coatings of rubber solution to a mold, not rarely yields blistered goods. There are small bubbles throughout the mass, which is likely to wear badly and soon become leaky. According to some authorities the atmospheric moisture is responsible for the mischief. The solvent evaporates and cools the rubber surface; moisture is condensed in a fine dew, which impairs the cohesion of the layers. The remedy lies in drying the air, either by absorbing the moisture or by cooling the air below the temperature which the rubber can assume. The latter arrangement is preferable. One method is to cool the air, heat it again a little—lest the low temperature render the evaporation of the solvent too sluggish—and dry it. The arrangement does not appear to be free from objections, but the process is a continuous one, which has its advantages.

Mr. R. Schlechter's report on his West African expeditions, addressed to the German colonial committee, which sent him out to study the possibilities of rubber cultivation in German territory, will probably have some influence on the future of German competition in the raw rubber market. He says that on his numerous excursions into the district surrounding Ngoko station, he found the kickxia tree in great abundance. One man could easily collect in a day sufficient milk to make about five and one-half pounds of rubber. An average stem, tapped in the afternoon, yields sufficient juice to make four and one-half pounds of rubber. In the Congo State, one pound of rubber collected by a man in a day is considered a fair average. It is evident, therefore, that the southeast territory is much richer, if it is not the richest rubber province of all Africa. He describes the different methods adopted in order to convert the milk into rubber, and mentions (1) boiling after mixing with water, (2) boiling the milk after mixing with water and acids, (3) the centrifugal process, (4) smoking, (5) tapping the water from the rubber. He found it necessary to instruct the officials and natives as to the best and simplest method to produce a good quality and took care to impress upon them that they could command a better price for really good rubber than for watered caoutchouc.

Herr Schneider, of Strassburg, has brought out a new substitute for gutta-percha, which is favorably reported upon by the polytechnic institute of that city. No information has yet been given as to the composition of the material. In ordinary temperature, it is hard, like pitch, and fairly firm against pressure, but not brittle. It does not break when hammered, even at freezing point; in a warmer atmosphere, the mass softens. Thin plates kept in sea water at 34 degrees Fahrenheit did not lose in weight in a fortnight nor did the water take up anything by solution.

*Of 220 pounds (100 kilogrammes).

SPRINGVILLE, N. Y.—The Springville Telephone Company, of Springville, Erie County, has been incorporated; capital, $3,000. Directors: M. N. Brooksell, F. D. Smith and A. A. Churchill, of Springville.

CORPORATION NEWS

DOVER, DEL.—The Union Light and Heat Company, of Cincinnati, has been incorporated with a capital of $200,000.

DESPLAINES, ILL.—The F. E. Bell Telephone Company, of Desplaines, has been incorporated. Capital stock, $10,000; incorporators: Frank E. Bell, Edward A. Manuel and William Nunn.

SPRINGVILLE, N. Y.—The Springville Telephone Company, of Springville, Erie County, has been incorporated. Capital, $5,000; directors: M. N. Brooksell, F. D. Smith and A. A. Churchill, of Springville.

HENRIETTA, TEX.—The Farmers and Merchants' Telephone Company, of Henrietta, has been incorporated. Capital, $1,200; incorporators: J. D. Stine, A. C. Thompson, W. B. Worsham, all of Henrietta.

MONTICELLO, IND. — The Monticello Telephone Company, of Monticello, Ind., has been incorporated; capital stock, $25,000; directors: Madison T. Didlake, Marcellus Waltz, John W. Jost, John G. Clark and Thadeus E. Hanway.

RIDGEVILLE, IND.—The Ridgeville Telephone Company, of Ridgeville, has been chartered to operate a telephone exchange. Capital, $8,000; incorporators: S. C. Long, R. O. Fraser, D. G. Heister, M. T. Sumptein, all of Ridgeville.

DRESDEN STATION, N. Y.—The Cooperant Telephone Company, of Dresden Station, Washington County, has been incorporated. Capital, $15,000; directors: R. N. Clemens, Dresden Station; J. A. McLaughlin, Putnam; E. J. Gray, Whitehall.

NEW AUGUSTA, IND.—The Independent Telephone Company, of New Augusta, has been chartered to operate telephone exchange. Capital, $10,000; incorporators: M. J. Nagle, W. Johnson, W. B. McDonald, J. Harcourt, G. T. Avery, all of New Augusta.

SANDUSKY, OHIO—The Citizens' Electric Light and Power Company, of Sandusky, capital $100,000 has been incorporated by John Sherwin, J. B. Hanna, H. A. Everett, B. Mahler, W. H. Price, Geo. A. Stanley, James Hoge, C. H. Stewart and Chas. W. Wasson.

GREELEY, COLO.—The Greeley Independent Telephone Company, of Greeley, has been organized to construct telephone wires. Capital, $10,000; incorporators: A. W. Trenholm, B. F. Johnson, J. E. Neill, G. F. Shear, all of Greeley.

ADVANCE, IND.—The Advance Telephone Company of Advance, has been chartered; capital stock, $2,000; directors: Thomas M. Shera, J. M. Sandy, M. P. Riner, J. V. Riner, P. J. Riner, Sullivan Leap, C. L. Airhart and B. F. Jones.

SEATTLE, WASH.—On the application of W. J. Grambs, receiver for the West Street & North End Electric Company, Judge Hanford has made an order summoning the creditors of the company to present their claims on or before October 1.

CLARKESBURG, W. VA.—The Fairmont & Clarkesburg Electric Railway Company has been incorporated by Ex-Senator Johnson N. Camden, of Parkersburg, and others, for the purpose of building an electric railway from Clarksburg to Fairmont. The capital stock is $100,000.

WILLMAR, MINN. — The Kandeyohi County Telephone Company, Willmar, has been chartered to conduct a telephone exchange. Capital, $10,000; incorporators: P. J. Haley, A. F. Hansom, J. M. Spicer, all of Willmar; J. O. Lundberg, of Svea; H. B. Eddy, of Whitefield.

FORT WAYNE, IND.—The Belden-Larwill Electrical and Manufacturing Company, of Fort Wayne, has been incorporated to manufacture electrical supplies. Capital, $100,000; incorporators: E. H. Belden, C. H. Larwill, S. M. Foster, C. A. Wilding, G. P. Evans, M. C. McDougal, A. Weil, all of Fort Wayne.

LIMA, OHIO—The Lima Telephone Company, of Lima, Ohio, has been incorporated for a general telephone and telegraph business. Capital, $100,000; incorporators: H. W. Neff, K. W. Huges, M. C. Purtscher, W. M. Miller, C. F. Stolzenback, all of Lima, Ohio; Cable & Parmenter, attorneys, Lima, Ohio.

POINT PLEASANT, W. VA.—The Mason County Telephone Company, of Point Pleasant, has been incorporated to operate telephone lines. Capital, $25,000; incorporators: F. B. Tippett, E. J. Mossman, both of Point Pleasant; F. A. Stemple, F. J. Spencer, C. C. Handy, all of Wanseon, Ohio; C. C. Handy, attorney, Wanseon, Ohio.

HUNTINGTON, W. VA.—The Ohio Valley Electric Railway Company, with a capital of $1,000,000, has filed articles of incorporation. The company is organized to operate a road from Huntington, W. Va., to Ironton, Ohio. Thomas J. Ryan, H. S. Calo and others, incorporators. Huntington, W. Va., is the principal place of business.

BALDWIN, WIS.—The Baldwin Telephone Company has filed articles of incorporation and elected the following officers: President, Dr. George Martin; vice-president, George Pittman; secretary, C. N. Gorham; treasurer, Frank Settergren; directors, Messrs. Martin, Pittman and Charles Settergren. This is a local exchange and will be completed in three months.

YORK FURNACE, PA.—The York Furnace Electric Company, which was granted a charter at Harrisburg, is composed of Lancaster capitalists. Their purpose is to develop the water-power in the Susquehanna, near York Furnace, and build an immense electric power house. The incorporators are John W. Holman, George B. Wilson, Newton J. Miller, William F. Beyer and Frederick Shoff.

CLYDE, N. Y.—Myron C. Taylor, representing George Rodwell, George H. Rodwell and Charles A. Lux, of Clyde; the Morris Machine Works, of Baldwinsville, and the Westinghouse Electric and Manufacturing Company, of Pittsburgh, Pa., creditors of the Clyde Gas and Electric Company, has secured an order from Circuit Judge Hazel of Buffalo, requiring all parties interested to show cause September 4, at Buffalo, why the corporation should not be placed in involuntary bankruptcy.

Wall Street and the Electrical Stock Market.

The principal feature of the market during the week has been the absolutely uneventful character of its transactions. Weekly trade reports have told of growing confidence in business and of a good distribution of goods, particularly in the Western centres. The reports are in the main encouraging and the demand for raw material and for many manufactured products is increasing to an extent that has caused a stiffening of prices in many cases.

On the New York Stock Exchange, General Electric closed the week at 138 bid and 138½ asked, a gain of 2 points for the week and of 8½ points in three weeks. Metropolitan Street Railway, of New York, closed at 153¼ bid and 154 asked, showing a loss of 1¼ points in the bid price for the week. Third Avenue Railroad closed at 109½ bid and 111 asked, showing a falling off of ⅞ of a point for the week. Brooklyn Rapid Transit closed at 53⅛ bid and 53⅜ asked, showing the considerable loss of 4⅛ points for the week. Manhattan Railway, of New York, closed at 91¼ bid and 92 asked, a loss of ¼ point for the week.

On the Boston exchange, American Telephone closed at 143 bid and 144 asked, showing a gain of 1 point over last week's quotations. Erie Telephone closed at 96 bid and 98 asked, a gain of 1 point in the asked price, the bid price remaining the same. New England Telephone was quoted at closing at 123½ bid and 125 asked.

On the Philadelphia exchange, Electric Storage Battery was not quoted. Union Traction closed at 36¾ bid and 37 asked, a loss of ¼ point for the week. Electric Company of America closed at 8⅞ asked and 9 bid, a loss of ¼ point for the week.

On the curb, or outside market, in New York, Electric Vehicle closed at 16 bid and 19 asked, showing no change for the week. Electric Boat closed at 13 bid and 16 asked, also having remained inactive during the week.

Wall Street, August 25.

Improved Alternating-Current Wattmeter.

The accompanying illustrations show the construction of a new and improved type of Scheeffer alternating-current integrating wattmeter, manufactured by the Diamond Meter Company, of Peoria, Ill. This improved meter is designated as type "E."

In the early meter days Mr. Scheeffer, recognizing the defects of existing meters, due to contact points in one or more of the measured currents, brought out the induction wattmeter, claimed to be the first manufactured in the United States, as previous induction meters for alternating current manufactured in the United States were amperemeters.

Mr. Scheeffer has since devoted his time developing and improving the present type of induction meter which is the result of much experience and care, and aims to supply a meter to meet the more exacting demands of central stations.

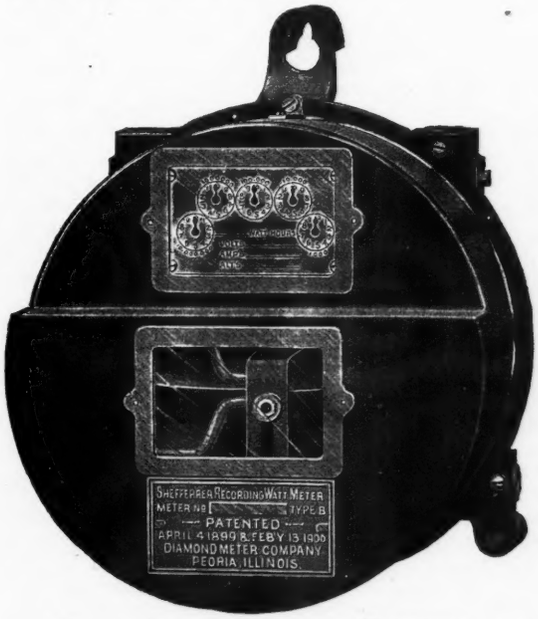


FIG. 1.—ALTERNATING-CURRENT WATTMETER.

To meet the conditions of modern meter service the meter has been reduced in size and weight. The type which the company has been manufacturing weighs about 18 pounds, but this has been reduced with a sheet metal case to 11 pounds.

The meters are furnished with sheet metal cases to keep down the weight, but cast-iron cases are furnished when desired, adding one or two pounds to the weight.

The meter is sealed at the factory and is ready for installing without any further adjustment, as all connections are on the outside, and it is not necessary to open the meter. It is made dust and bug-proof.

One great trouble in previous motor meters has been the deterioration of the jewel and bearing, this being due to the heavy moving element which, under the pulsating alternating current of considerable strength would wear away the polish of the jewel and bearing, causing increased friction. While this as a rule does not affect the full load of the meter, it causes the meter to lose its sensitiveness because of increased friction of its bearing and therefore to run slow on light loads, or even not to register. Of late a number of devices have been adopted to overcome these defects, some very expensive and complicated. Mr. Scheeffer has overcome the difficulty in a very simple and efficient manner. The method adopted is in first making the moving element very light. It consists of a very light and thin aluminum disk with a shaft of light brass tube, the whole weighing but 12 grammes. In the second place, this moving element is rested on a highly polished and hardened steel ball contained in a sapphire cup. The advantage of this form of bearing is that the steel ball can be made very accurate and is always self-centring, and can at any time be quickly replaced by a new one in connection with the jewel, giving the meter a new bearing without any change or even disturbing the full load calibration. Third, the disk is subjected to so slight a force from the shunt that there are no vibrations of the disk.

The laminated iron magnets with the shunt coils are so constructed that the magnetic flux from them is mostly shunted through an iron mass and very little of the magnetic flux passing through the disk. As the total current consumed by the shunt magnets is about one watt, and only one-twentieth of this is allowed to pass through the disk, a force of one-twentieth watt acts on the disk. This is so slight that no vibrations of the disk take place and in connection with its light weight makes a bearing which remains almost frictionless indefinitely. The illustration shows the manner of taking out the ball and jewel for inspection or replacing and is indeed a very simple operation.

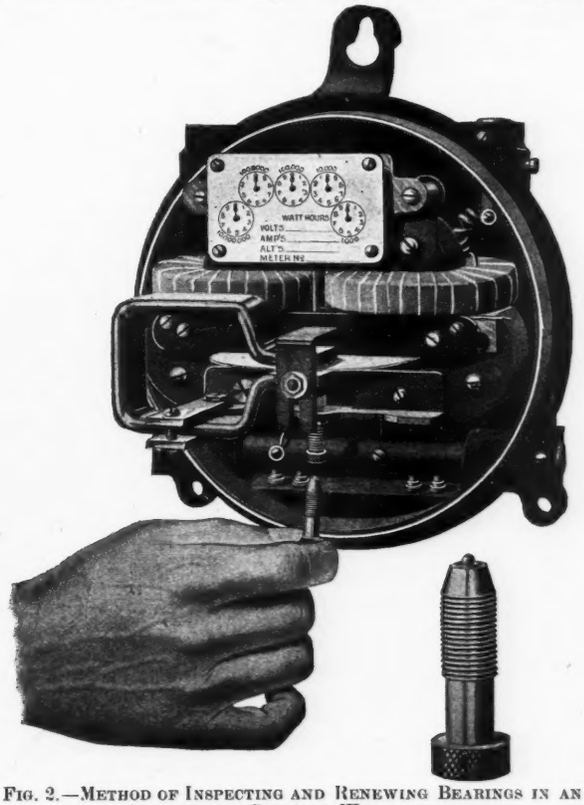


FIG. 2.—METHOD OF INSPECTING AND RENEWING BEARINGS IN AN ALTERNATING-CURRENT WATTMETER.

The series coil which carries the lighting load consists of only a few turns of thick wire and is coreless, the loss and drop through it is too small to be ordinarily measured as the total loss in meter at full load is two or three watts; this also admits of the meter being overloaded 50 per cent without any alteration of its accuracy. The meter responds quickly to sudden changes of load because of its light moving element and this lightness of moving parts makes it extremely sensitive. A meter of ordinary size will register correctly a two candle-power lamp. The meter is direct reading, no constant being employed, and is claimed to be correct on any inductive or non-inductive load.

INDUSTRIAL NOTES

United Electric Heating Company, Detroit, Mich., is just receiving from the printer's several interesting pamphlets and catalogues of new designs of electrical heating apparatus.

The Lea Arc Lamp Company, Anderson, Ind., is just placing on the market a new type of arc lamp designed by Mr. Lea, who has been prominently known in the electrical field for several years.

The Safety-Armorite Conduit Company, Rankin Station, Pa., is erecting two new buildings; one 100 by 260 feet, and one 150 by 150 feet. They will be of iron construction throughout, and are being erected by the American Bridge Company, of New York city.

The Edward P. Allis Company, Milwaukee, Wis., informs its patrons and the public in general that, on September 1, it will discontinue its office at Butte, Mont., and establish a branch office at Spokane, Wash., 100 Mill street, in charge of Mr. H. V. Croll.

The Swedish-American Telephone Company, Chicago, will shortly begin the manufacture of a complete line of switchboards. Recently it has made improvements in its factory which places the company in position to handle the work in connection with the sale of telephone apparatus.

The Incandescent Electric Light Manipulator Company, Boston, Mass., maker of the apparatus for handling incandescent lamps which may be located high or out of reach, and for cleaning lamps, reports that its factory is again in operation after an unfortunate fire, and that it has orders enough on hand to keep it busy for several weeks.

The American Battery Company, 172 South Canal street, Chicago, Ill., recently reported to a representative of this journal that its factory was extremely busy with an unusually heavy line of orders. This company was established in 1889, and is one of the pioneers in the construction of electric storage cells. Its battery is claimed to be absolutely non-infringing and all cells are protected by a guarantee.

The Syracuse Arc Lamp Company, Syracuse, N. Y., has recently opened a branch office at 26 Cortlandt street, New York. The office is in charge of Mr. B. N. Sperry, vice-president of the company, who will take care of the sales of the new arc lamp in Greater New York. This office will also be headquarters for the Davis incandescent lamp, for which lamp Mr. Sperry is agent in the same territory.

The L. B. Allen Company, Incorporated, Chicago, manufacturers of the Allen soldering stick, have established eastern headquarters at 234 Greenwich street, New York city. The company's long-distance telephone call is 4,803 Cortlandt. Eastern patrons of the company are thus insured prompt and careful service from a large stock of the company's specialties, which will always be kept on hand.

An official of the Electric Storage Battery Company, of Philadelphia, speaking of the company's general business, says it has recently made some good contracts, including that for equipping the Thirty-fourth street branch of the Metropolitan Street Railway Company, of New York. The reported results of the company's business for the six months ended June 30 were $1,400,000, against $525,000 last year, an increase of $875,000.

The Sprague Electric Company, 527-531 West Thirty-fourth street, New York city, has issued Bulletin No. 200, describing the Lundell motor equipments for printing establishments and book binderies. The bulletin is more than usually elaborate in character and is excellently illustrated. The pictures show adaptations of the Lundell motor to nearly every piece of machinery used in a printing establishment. Another bulletin just issued by the same company describes and illustrates the Greenfield flexible steel-armored conductors. It is numbered 401. Both of these bulletins may be obtained free of charge on application to the above address.

The Moloney Electric Company, St. Louis, Mo., manufacturers of the Moloney transformer, has made close regulation a salient feature of its type A transformer. In fact, so insignificant is the magnetic leakage in this transformer, it is said, that it is hardly discernible under the severest tests. This company is just issuing an interesting pamphlet containing data relative to transformer regulation for alternating-current series arc lamps. W. R. Garton Company, Chicago, and the Northwest Electric Engineering Company, of Portland, Ore., carry a full stock of Moloney transformers. The Western Electrical Supply Company, St. Louis, is the general sales agent for this transformer.

Shipments are now being made by the Bullock Electric Manufacturing Company, of Cincinnati, on the $500,000 contract made with a French syndicate some time ago for electrical equipment for street railways in different parts of the eastern hemisphere. Two large street railway 800-kilowatt generators have been consigned to Alexandria, Egypt, and a 400-kilowatt generator to Algiers. A large generator is also being shipped to Lyons, France. The Bullock Company is shipping a good deal of work outside of the country, there being in this line some five cars of apparatus for the Russian-Chinese Railroad, a large lot of work for the United States Government in the Philippines, generators for United States transports, 30 in number, and a large printing press equipment for St. Petersburg.

The Westinghouse Electric and Manufacturing Company has been awarded a contract for the equipment of an electric light station at Seoul, the capital of Corea. The contract is worth $21,000 to the Westinghouse Company, but is chiefly important owing to the fact that the machinery is to be sent half way across the world to a nation which is slow in adopting Western methods. The capital city has a small electric lighting plant at the present time, built by English money, but it is a very primitive affair and will be torn down and a new power house erected for the machinery that will be supplied by the Pittsburgh concern. The material will be made at the works at East Pittsburgh, and will be sent to New York and to Corea by the water route, which is cheaper than sending it overland across the country, and then across the Pacific.

In one after another of the Besse Syndicate New England Stores the Frink system of show window and store lighting has been installed. As this work has extended over a period of two years, the proprietors have had ample time to test the efficiency and economy of the system, and it is said to be a fact when once a mercantile concern has used this system it never goes back to another, either when building new stores or remodeling old ones. Among other recent important contracts reported by I. P. Frink, are 30 of the Woolworth 5 and 10-cent stores in different parts of the country, in which the window reflectors are being installed. Rogers, Peet & Company, whose old store at the corner of Warren street and Broadway, New York city, was burned last year, have installed the Frink reflectors in their new store on the same site, after having used and tested them in their store at Thirty-second street and Broadway. The May stores at Denver, St. Louis (the Famous) and Cleveland, and particularly the six stories of show windows of the Cleveland store, brilliantly lighted by the Frink system, we have referred to before in these columns.

The Pratt Institute, Brooklyn, N. Y., has issued a pamphlet describing in detail the department of science and technology, which is under the direction of Professor Arthur L. Williston. Referring to the department's two-year courses in steam and machine design and applied electricity, Professor Williston says: "Our courses are not intended to train expert engineers or specialists, as are the courses of the best engineering schools of this country, in which the work is necessarily so theoretical and involves so much higher mathematics that it is necessary to spend the whole of the first two years on top of a good high school education preparatory to taking up any of the technical work of the last two years. Our aim is to make our work thoroughly practical, using drawing board and laboratory methods wherever possible, and to simplify our class-room and theoretical work so as to require no mathematics higher than plane trigonometry. Starting with lower requirements for admission, we are thus able, in two years, to give our students a thorough training in the theory and practice of mechanical and electrical work, which prepares them later to fill positions of superintendents, managers, chief draughtsmen and designers in industrial plants. The record of our graduates is our best proof of these claims."